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L1: Entry 2 of 2 File: DWPI May 2, 1997

DERWENT-ACC-NO: 1997-302991
DERWENT-WEEK: 199728

TITLE: Sound field reproducing apparatus such as audio video device - adds output signal of sound field expansion circuit and audio/non-audio extraction circuit with predetermined volume and output through speakers

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PATENT-FAMILY:

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ABSTRACTED-PUB-NO: JP 09114479A
BASIC-ABSTRACT:

The apparatus has an audio removal circuit (12) which removes an audio signal from the input stereo signal. A reflected sound signal is added to the output signal of the audio removal circuit, in a reflecting sound addition circuit (14).

A sound field expansion circuit (15) processes the output signal and extends the sound field. An audio or non-audio extraction circuit (13) extracts the audio/non-audio signals from the input stereo signal. An addition circuit (16) adds the output signal of the sound field expansion circuit and the audio/non-audio extraction circuit, with the predetermined sound volume, and outputs the signal through the speakers (9,10).

ADVANTAGE - Enables audio signal reproduction, clearly.

ABSTRACTED-PUB-NO: JP 09114479A
EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.1/13

DERWENT-CLASS: P86 U22 W04
EPI-CODES: U22-G; W04-R01C;

PATENT ABSTRACTS OF JAPAN

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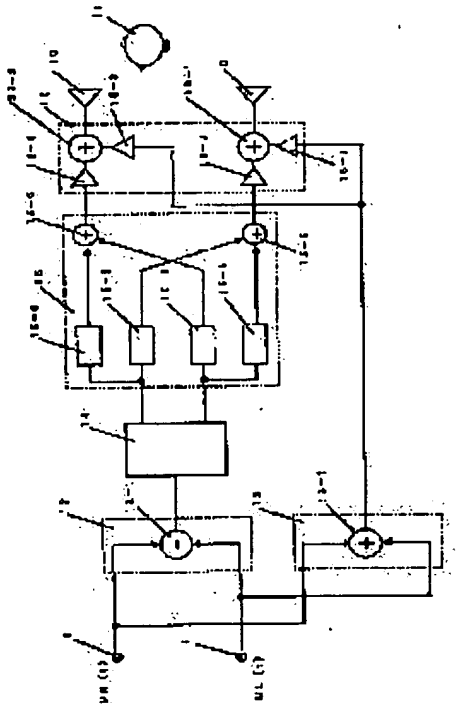
(54) SOUND FIELD REPRODUCING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To reproduce a sound field having a range equal to or wider than that in the conventinal practice without impairing clarity of voice signals.
SOLUTION: Voice signals are eliminated from inputted stereo two channel signals in a voice signal eliminating circuit 12 and reflection sounds are added to the output signals in a reflection sound adding circuit 14 and the outputs of the circuit 14 are processed so that the sound field is expanded in a sound field expanding circuit 15. A voice extracting circuit 13 extractes voice signals from the inputted stereo two channel signals. An adding circuit 16 adds output signals of the sound field expanding circuit 15 and the voice extracting circuit 13 with a prescribed volume to output them to the outside with speakers 9, 10.



LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] The sound field regenerative apparatus characterized by providing the following. The voice and a non-voice signal acquisition means to acquire a sound signal and a non-voice signal from the inputted correspondence number. A sound field processing means to perform predetermined processing for extending sound field to the non-voice signal acquired by the aforementioned voice and non-voice signal acquisition means. An addition means to add the output signal of the aforementioned sound field processing means to the sound signal obtained by the aforementioned voice and non-voice signal acquisition means. The output means for outputting the output signal of the aforementioned addition means.

[Claim 2] The aforementioned sound field processing means is a sound field regenerative apparatus according to claim 1 characterized by having the sound field expansion means which the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field using a sound effect addition means to add a reflected sound and/or reverberation sound and to output to the aforementioned non-voice signal, and its output signal.

[Claim 3] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The two or more loudspeaker sections which emit considering the output signal of the sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, a voice extraction means extract the aforementioned sound signal from the aforementioned signal, the aforementioned sound field expansion means and an addition means apply the output signal of the aforementioned voice extraction means with predetermined volume, and the aforementioned addition means, as sound.

[Claim 4] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and a voice extraction means, by the predetermined time interval, Two or more loudspeakers which emit as sound the output signal of an addition means to apply the output signal of the aforementioned sound field expansion means and a voice extraction means using the volume ratio measured with the aforementioned amount measurement means of voice, and the aforementioned addition means.

[Claim 5] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, Two or more loudspeakers which emit as sound the output signal of an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and the aforementioned addition means.

[Claim 6] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, Two or more loudspeakers which emit as sound the output signal of an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and the aforementioned addition means.

[Claim 7] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The sound field

expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, Two or more loudspeakers which emit as sound the output signal of an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and the aforementioned addition means.

[Claim 8] The sound field regenerative apparatus characterized by providing the following. An input means to input a signal. A voice removal means to remove a sound signal from the aforementioned signal. A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means. The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, Two or more loudspeakers which emit as sound the output signal of an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and the aforementioned addition means.

[Claim 9] The aforementioned addition means is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 characterized by only for predetermined time delaying the output signal of the aforementioned voice extraction means, and adding it.

[Claim 10] The signal added as an output signal of the aforementioned voice extraction means in the aforementioned addition means is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 characterized by being a monophonic recording.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the sound field regenerative apparatus which can perform a sound reproduction with presence for example, in AV (audio-visual) device.
[0002]
[Description of the Prior Art] In order to enjoy a movie by the spread of VTRs in an image and a sound field at home in recent years, a sound reproduction with a big screen and presence is desired, and not only a movie but in order to enjoy a music title, a sound reproduction with presence is desired, and development of the hardware corresponding to this is needed.
[0003] Hereafter, it explains, referring to a drawing about the conventional sound field regenerative apparatus.
[0004] Drawing 13 is the hardware block diagram showing the composition of the conventional sound field regenerative apparatus.
[0005] The input terminal into which 1 and 2 input a signal in drawing 13 , the multiplier with which 3 hangs -1 on an input signal, The adder with which 4 adds an input signal, the delay machine to which 5 carries out the time delay of the input signal, The adder with which 7 and 8 add an input signal, the multiplier with which 6 hangs -1 on an input signal, the loudspeaker to which 9 and 10 carry out the sound reproduction of the signal outside, and 11 are the listening persons who met loudspeakers 9 and 10, and are ML (t) (t expresses continuous time and it expresses that ML (t) is a time function.). the following -- being the same -- as for the Lch signal of a stereo audio signal, and MR (t), the Rch signal of a stereo audio signal and tau 3 are the time delays in the delay machine 5
[0006] About the conventional sound field regenerative apparatus constituted as mentioned above, the operation is explained using drawing 13 .
[0007] From an input terminal 1, ML (t) is inputted, from an input terminal 2, MR (t) is inputted, the inputted signal is divided into two, respectively, MR (t) is inputted into an adder 4 and an adder 8, and ML (t) is inputted into a multiplier 3 and an adder 4. In a multiplier 3, -1 is hung on ML (t), and, as a result, it is. - ML (t) is inputted into an adder 4. In an adder 4, MR (t) and -ML(t) is added, MR(t)-ML(t) is outputted as the result, and it is inputted into the delay machine 5. Only time tau 3 delays MR(t)-ML(t) with the delay vessel 5, and MR(t-tau 3)-ML (t-tau 3) is outputted. As for the output signal of the delay machine 5, while branches to two, a signal is inputted into an adder 8, and another side is inputted into a multiplier 6. In a multiplier 6, -one is hung on MR(t-tau 3)-ML (t-tau 3), and - (MR(t-tau 3)-ML (t-tau 3)) which it is as a result is inputted into an adder 7. In an adder 8, addition of MR (t) and MR(t-tau 3)-ML (t-tau 3) is performed, and MR(t)+MR(t-tau 3)-ML (t-tau 3) which it is as a result is outputted from a loudspeaker 10. In an adder 7, ML (t) and - (MR(t-tau 3)-ML (t-tau 3)) are added, and ML(t)- (MR(t-tau 3)-ML (t-tau 3)) which it is as a result is outputted from a loudspeaker 9.
[0008] At this time, from one side of two loudspeakers to MR(t-tau 3)-ML (t-tau 3) A signal which is an antiphase mutually is mixed with an input signal, and it is reproduced. from another side, it is called - (MR(t-tau 3)-ML (t-tau 3)) -- Sound field which the normal position of an image does not understand by this are generated (or when the signal subtracted negates a cross talk component, it becomes the feeling which the right-and-left signal has become from the outside [loudspeaker / each].). . And sound field with a feeling of a breadth or presence are generated by adjusting mix balance with ML (t) which is the direct sound to which no processing processings are carried out, and MR (t).
[0009]
[Problem(s) to be Solved by the Invention] However, with the above composition, the mix balance of antiphase sound and a direct sound will adjust size of an effect, and when there were few effects when antiphase sound was small, and it enlarged sound / antiphase] so that an effect might be known, the technical problem that voice became not clear occurred.
[0010] The purpose of this invention is also being able to reproduce a sound signal clearly and offering the sound field regenerative apparatus which it spreads simultaneously and can make a listening person sense admiration in consideration of the above conventional technical problems.
[0011]
[Means for Solving the Problem] The voice and a non-voice signal acquisition means to acquire a sound signal and a non-voice signal from the correspondence number into which the sound field regenerative apparatus of this invention was inputted, As opposed to the non-voice signal acquired by the aforementioned voice and non-voice signal acquisition means It has a sound field processing means to perform predetermined processing for extending sound field, an addition means to add the output signal of the aforementioned sound field processing means to the sound signal obtained by the aforementioned voice and non-voice signal acquisition means, and an output means for outputting the output signal of the aforementioned addition means.
[0012] According to this this invention, the natural breadth which can also reproduce a sound signal more clearly compared with the former, and has presence is reproducible.
[0013]
[Embodiments of the Invention] The voice and a non-voice signal acquisition means to acquire a sound signal and a non-voice signal from the correspondence number into which invention of this invention according to claim 1 was inputted,

As opposed to the non-voice signal acquired by the aforementioned voice and non-voice signal acquisition means It is the sound field regenerative apparatus equipped with a sound field processing means to perform predetermined processing for extending sound field, an addition means to add the output signal of the aforementioned sound field processing means to the sound signal obtained by the aforementioned voice and non-voice signal acquisition means, and the output means for outputting the output signal of the aforementioned addition means. As opposed to the non-voice signal from which the sound signal and the non-voice signal were acquired from the correspondence number into which voice and the non-voice signal acquisition means were inputted in this invention, and the sound field processing means was acquired by the aforementioned voice and non-voice signal acquisition means Predetermined processing for extending sound field is performed, the output signal of the aforementioned sound field processing means is added to the sound signal from which the addition means was acquired by the aforementioned voice and non-voice signal acquisition means, and an output means outputs the output signal of the aforementioned addition means to it.

[0014] Invention of this invention according to claim 2 is a sound field regenerative apparatus according to claim 1 which has the sound field expansion means which the aforementioned sound field processing means can make the arbitrary positions of space able to orientate an image substantially using a sound effect addition means to add a reflected sound and/or reverberation sound and to output to the aforementioned non-voice signal, and its output signal, and can extend sound field. In this invention, a sound effect addition means can add and output a reflected sound and/or reverberation sound to the aforementioned non-voice signal, and a sound field expansion means can make the arbitrary positions of space able to orientate an image substantially using the output signal, and sound field can be extended.

[0015] An input means by which invention of this invention according to claim 3 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, It is the sound field regenerative apparatus equipped with a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, the aforementioned sound field expansion means and an addition means to apply the output signal of the aforementioned voice extraction means with predetermined volume, and the two or more loudspeaker sections that emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And an addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with predetermined volume. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0016] An input means by which invention of this invention according to claim 4 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and a voice extraction means, by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and a voice extraction means using the volume ratio measured with the aforementioned amount measurement means of voice, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by the predetermined time interval. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the volume ratio called for with the amount measurement means of voice. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0017] An input means by which invention of this invention according to claim 5 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal

from the signal inputted into the input means. And a variation measurement means inputs the signal inputted into the input means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0018] An input means by which invention of this invention according to claim 6 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And a variation measurement means inputs the output signal of a voice removal means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0019] An input means by which invention of this invention according to claim 7 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by the predetermined time interval. Moreover, a variation measurement means inputs the signal inputted into the input means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the amount of voice calculated by the amount measurement means of voice, and the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a televiewer as sound by two or more loudspeakers.

[0020] An input means by which invention of this invention according to claim 8 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by

the predetermined time interval. Moreover, a variation measurement means inputs the output signal of a voice removal means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the amount of voice calculated by the amount measurement means of voice, and the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a televiewer as sound by two or more loudspeakers.

[0021] It is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 which the aforementioned addition means delays [time / predetermined] the output signal of the aforementioned voice extraction means, and add invention of this invention according to claim 9.

[0022] The signal with which invention of this invention according to claim 10 is added as an output signal of the aforementioned voice extraction means in the aforementioned addition means is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 which are a monophonic recording.

[0023] Hereafter, the form of operation of this invention is explained using drawing..

[0024] Drawing 1 is the block diagram showing the composition of the sound field regenerative apparatus which is one form of operation concerning this invention. The composition of one form of this operation is explained as the 1st example, referring to this drawing.

[0025] In addition, the portion which has the same function as the conventional example attaches the same sign, and omits detailed explanation.

[0026] In drawing 1 , the signal ML of Lch (t) inputted into the input terminal 1 and the signal MR of Rch (t) inputted into the input terminal 2 branch to two, respectively, one signal is given to the voice removal circuit 12, and the signal of another side is inputted into the voice extraction circuit 13. The voice and the non-voice signal acquisition means of this invention include the voice removal circuit 12 and the voice extraction circuit 13.

[0027] The voice removal circuit 12 consists of subtractors 12-1 which search for the difference of two inputted signals, and the output is given to the reflected-sound addition circuit 14 which adds a reflected sound to an input signal. The output signal of the reflected-sound addition circuit 14 is inputted into the sound field expansion circuit 15. The sound field expansion circuit 15 consists of the FIR filter 15-1, 15-2, 15-3, 15-4, an adder 15-5 adding an input signal, and 15-6. Here, the sound field processing means of this invention is a means including the reflected-sound addition circuit 14 and the sound field expansion circuit 15.

[0028] The voice extraction circuit 13 consists of adders 13-1 adding two inputted signals, and the output signal of this branches to two and is inputted into an adder circuit 16. Moreover, two output signals of a sound field expansion circuit are also inputted into an adder circuit 16. The adder circuit 16 consists of a multiplier 16-1, 16-2, 16-3, 16-4, and an adder 33-1 and 33-2, in order to add the signal inputted at a predetermined rate.

[0029] Two output signals of an adder circuit 16 are emitted to the listening person 11 by loudspeakers 9 and 10, respectively.

[0030] The FIR filter 15-3 and 15-4 are the FIR filters which have an impulse response which an image orientates by FIR filtering to the listening person's 11 method of right-hand side or method of the right rear, and the FIR filter 15-1 and 15-2 are FIR filters which have an impulse response which is collapsed and an image orientates according to an operation to the listening person's 11 method of left-hand side or method of the left rear.

[0031] That is, the FIR filter 15-4 has an impulse response hRR (t), the FIR filter 15-3 has an impulse response hRL (t), the FIR filter 15-2 has an impulse response hLR (t), and the FIR filter 15-1 has the impulse response hLL (t).

[0032] In addition, although not shown drawing, the power amplifier which amplifies the power of a signal minds the signal outputted to loudspeakers 9 and 10, and it is outputted to loudspeakers 9 and 10.

[0033] Thus, operation of the sound field regenerative apparatus in the 1st constituted example is explained.

[0034] First, acoustic signals, such as voice and music, are inputted from input terminals 1 and 2, it branches to two, respectively, one signal is inputted into the voice removal circuit 12, and the signal of another side is inputted into the voice extraction circuit 13. In the voice removal circuit 12, the difference of the inputted signal is searched for by the subtractor 12-1, and it is inputted into the reflected-sound addition circuit 14.

[0035] The sound signal of the singer who orientates in the center at the time of the music signal accompanied by [signal / difference / which is searched for in the voice removal circuit 12] a singer in an input signal is offset, and serves as a reverberation component of Lch and Rch inserted at the time of recording or broadcast. For this reason, a sound signal is removable from a stereo 2ch signal. Moreover, conversely, in order to ask for the sum of the inputted signal with an adder 13-1, voice is emphasized in the voice extraction circuit 13.

[0036] Drawing 2 (a) and (b) show typically the reflected-sound sequence added in the reflected-sound addition circuit 14, and the vertical axis shows [the horizontal axis] an amplitude by time. For example, it is the reflected-sound sequence added since the reflected-sound sequence and drawing 2 (b) which are added since drawing 2 (a) outputs to the Rch side output to the Lch side. These reflected sounds are called for by the measurement in an actual hole, and the simulation using the sound ray method etc.

[0037] Drawing 3 (a) and (b) are drawings explaining the reflected-sound addition circuit 14 which actually adds this reflected sound. The delay machine with which only the time when 17 was shown by the input terminal and 18 was shown by taui (i is the same as that of a suffix and the following) is delayed in drawing 3 (a), the multiplier (it is called a tap) which performs the multiplication of the value which 19 calls tap coefficient shown by X (i), and the signal outputted from each delay machine, the adder which takes total of the signal with which 20 be outputted from each tap, and 21 When this display is performing the notation in the case of using a digital signal and it treats an analog signal, before being inputted into this reflected-sound addition circuit 14, conversion to the digital signal by the A/D converter is required (setting in one form of this operation it is the same as that of the following digital from an analog which this A/D converter omits and is shown also in the portion to be changed). Thus, the reflected-sound addition circuit 14 consists of FIR filters, it is constituted by the delay machine 18 and the tap 19, and, in the case of drawing 3 (a), a reflected-sound sequence as shown in drawing 3 (b) is acquired. On the contrary, what is necessary is just to set each amplitude X (i) and time delay taui as the tap and delay machine of drawing 3 (a) to set up a reflected sound as shown in drawing 2 (a) and (b). This is constituted by DRAM (die

NAMMIKKU random access memory), DSP (digital signal processor), etc. in fact.
[0038] Like this example, when the input to the reflected-sound addition circuit 14 stereo-izes an output signal by one piece (to two signals), two circuits (FIR filter) shown by drawing 3 (a) are used, and the tap coefficient set as this sets up the thing of a different value.
[0039] Two signals with which the reflected sound was added in the reflected-sound addition circuit 14 are inputted into the sound field expansion circuit 15.
[0040] In the sound field expansion circuit 15, the signal outputted to the R side is inputted into the FIR filter 15-3 and 15-4, and the signal outputted to the L side is inputted into the FIR filter 15-1 and 15-2. In the FIR filter 15-1 and 15-2, the inputted signal collapses so that an image may orientate to the method of left-hand side [loudspeaker / 9], or a listening person's method of the left rear, and an operation is performed.
[0041] Here, how to make an image orientate in the arbitrary directions virtually is explained using drawing 4 . Drawing 4 is a principle view which generates virtually the image normal position equivalent to the case where a signal is reproduced, from the loudspeaker 25 prepared in the listening person's 11 method of left-hand side using the loudspeaker 9 of a left channel, and the loudspeaker 10 of a right channel. In this view, loudspeakers 9 and 10 are arranged ahead [of the listening person 11 / right-and-left]. And input signal S(t)22 are inputted into the FIR filters 23 and 24. The FIR filters 23 and 24 collapse an input signal by the impulse response hLR (t) set up as a tap coefficient, respectively, and hLL (t), and perform an operation. h1 (t) shown drawing is an impulse response in the position (it is the position of the eardrum correctly, and when measuring, it considers as the position of an auditory-meatus entrance) of the left ear of a loudspeaker 9 and the listening person 11. An impulse response [in / the position of the right ear of a loudspeaker 9 and the listening person 11 / similarly / in h2 (t)], An impulse response [in / the position of the left ear of a loudspeaker 10 and the listening person 11 / in h3 (t)], An impulse response [in / the position of the right ear of a loudspeaker 10 and the listening person 11 / in h4 (t)], an impulse response / in / the position of the left ear of a loudspeaker 25 and the listening person 11 / in h5 (t)], and h6 (t) are the impulse responses in the position of the right ear of a loudspeaker 25 and the listening person 11.
[0042] In such composition, when signal S (t) is outputted from a loudspeaker 25, the sound which reaches the listening person's 11 ear is as follows.
[0043] That is, sound pressure L (t) in a left ear is expressed with (1) formula.
[0044] L (t) = S(t) *h5 (t) ... (1)
Sound pressure R (t) in a right ear is expressed with (2) formulas.
[0045] R (t) = S(t) *h6 (t) ... (2)
However, * collapses and expresses the operation.
[0046] Moreover, in practice, although the own transfer function of a loudspeaker etc. will be multiplied, this may decide to ignore and may think that transfer functions, such as a loudspeaker, are included.
[0047] Moreover, time considers sound pressure [of (1) and (2) formulas], impulse response, and signal S (t) as a dispersed digital signal, and it is changed like (3), (4), (5), (6), and (7) formulas, respectively.
[0048]
L (t) -> L (n) ... (3)
R (t) -> R (n) ... (4)
h5 (t) -> h5 (n) ... (5)
h6 (t) -> h6 (n) ... (6)
S (t) -> S (n) ... (7)
In this case, (1) and (2) formulas become as shown in the following (several 1) and (several 2).
[0049]
[Equation 1]

$$L(n) = S(n) * h5(n) = \sum_{k=0}^{N-1} S(k) \cdot h5(n-k) \qquad \cdots (8)$$

[0050]
[Equation 2]

$$R(n) = S(n) * h6(n) = \sum_{k=0}^{N-1} S(k) \cdot h6(n-k) \qquad \cdots (9)$$

[0051] Here, the natural number n should be written by nT in practice, although T expresses the sampling time, generally omits T and writes it like (8) and (9) formulas.
[0052] Moreover, similarly, signal S (t) is emitted from loudspeakers 9 and 10, and (following 10) and following (11) formulas are materialized about the sound which reaches the listening person 11. That is, the sound pressure of a left ear serves as the following (10) formulas.
[0053]
L'(n) =S(n) *hLL(n) *h1 (n) +S(n) *hLR(n) *h3 (n) ... (10)
The sound pressure of a right ear serves as the following (11) formulas.
[0054]
R'(n) =S(n) *hLL(n) *h2 (n) +S(n) *hLR(n) *h4 (n) ... (11)
a premise [say / that sound can be heard from said if a head transfer function is equal] -- carrying out (this premise being right generally) -- the following (12) - (15) formula is materialized
[0055]
L (n) =L' (n) ... (12)
h5 (n) =hLL(n) *h1(n) +hLR(n) *h3 (n) ... (13)
R (n) =R' (n) ... (14)
h6 (n) =hLL(n) *h2(n) +hLR(n) *h4 (n) ... (15) Therefore, what is necessary is just to determine an impulse response hLL (n) and hLR (n) so that (13) and (15) formulas may be materialized.

[0056] for example, an impulse response h1 (t) - h6 (t) and hLL(t) - if hLR (t) is rewritten by expression of a frequency domain, it will become like following (16) - (23)
[0057]
H1(n) =FFT (h1 (n)) ... (16)
H2(n) =FFT (h2 (n)) ... (17)
H3(n) =FFT (h3 (n)) ... (18)
H4(n) =FFT (h4 (n)) ... (19)
H5(n) =FFT (h5 (n)) ... (20)
H6(n) =FFT (h6 (n)) ... (21)
HLL(n) =FFT (hLL (n)) ... (22)
HLR(n) =FFT (hLR (n)) ... (23)
However, FFT() expresses the function by which the Fourier transform (FFT) was carried out.
[0058] Next, if (13) and (15) formulas are rewritten by expression of a frequency domain, it collapses like (24) shown below and (25) formulas, and an operation will change to multiplication and the rest will become the transfer function which carried out the Fourier transform of each impulse response.
[0059]
H5 (n) = HLL(n) and H1(n) +HLR(n) and H3 (n) ... (24)
H6 (n) = HLL(n) and H2(n) +HLR(n) and H4 (n) ... (25)
In (24) and (25) formulas, except a transfer function HLL (n) and the value of HLR (n), since it is obtained by measurement, a transfer function HLL (n) and HLR (n) can be calculated like (26) and (27) formulas which are shown below.
[0060]
[Equation 3]

$$HLL(n) = \frac{H5(n) \cdot H4(n) - H6(n) \cdot H3(n)}{H1(n) \cdot H4(n) - H2(n) \cdot H3(n)} \quad \cdots (26)$$

[0061]
[Equation 4]

$$HLR(n) = \frac{H6(n) \cdot H1(n) - H5(n) \cdot H2(n)}{H1(n) \cdot H4(n) - H2(n) \cdot H3(n)} \quad \cdots (27)$$

[0062] Thus, determined HLL (n), hLL which carried out the inverse Fourier transform (IFFT) of the HLR (n) (n), the signal which gives signal S (n) to the FIR filters 23 and 24, and is outputted from a loudspeaker 9 using hLR (n) -- hLL (n) hLR (n) is collapsed in the signal outputted from a loudspeaker 10, and even if the listening person 11 does not actually sound the loudspeaker 25 of the method of left-hand side by emitting the signal, it can be sensed that sound is sounding from the direction. In drawing 4 , although the direction of a loudspeaker 25 was made into the method of left-hand side, the position of this loudspeaker is realizable by the same view not only depending on this but the method of right-hand side.
[0063] Therefore, it becomes possible by using the above methods to extend the sound field which an image can be made to orientate in the arbitrary directions (for the same to be said of upper and lower sides) virtually, and are reproduced rather than the time of the usual loudspeaker reproduction.
[0064] The fundamental composition of the FIR filter which performs a reefing operation is shown in drawing 5 . In this view, the input terminal into which 26 inputs a signal, the delay element from which only tau delays a signal as for 27, the value which 28 calls tap coefficient shown by h (n) and the multiplier which performs the multiplication of an input signal, the adder with which 29 adds an input signal, and 30 are output terminals which output a signal. Usually, DSP (Digital Signal processor) and exclusive use LSI to which such an FIR filter performs ****** at high speed are used.
[0065] Impulse response h (n) and the (length of the impulse response which n:0 to N-1 and N need) are set to a multiplier 28 as a tap coefficient like drawing 5 . Moreover, the time delay corresponding to the sampling frequency at the time of changing an analog signal into a digital signal is set to a delay element 27. And a reefing operation as shown by (8) and (9) formulas is performed by repeating ****** and delay to the signal inputted into an input terminal 26, respectively. this is omitted drawing, although the D/A converter which changes a digital signal into an analog signal is required for the A/D converter which changes an analog signal into a digital signal in front of this FIR filter, and back in practice, since signal processing is performed by the case of a digital signal (the following -- the same)
[0066] A loudspeaker is virtually created for an image by the FIR filter 15-1 and 15-2 as mentioned above to the method of left-hand side, or the method of the left rear, and sound field are expanded.
[0067] Similarly, in the FIR filter 15-3 and 15-4, the inputted signal collapses so that an image may orientate to the method of right-hand side, or the method of the right rear, and an operation is performed.
[0068] The output signal of an adder 15-5, the FIR filter 15-2, and the FIR filter 15-4 is inputted into an adder 15-6, and the output signal of the FIR filter 15-1 and the FIR filter 15-3 is added.
[0069] The output signal of the voice extraction circuit 13 and the sound field expansion circuit 15 is inputted into an adder circuit 16, and is added at a predetermined rate. An adder circuit 16 adds the signal inputted, respectively through a multiplier 16-1, 16-2, 16-3, 16-4 and an adder 33-1, and 33-2.
[0070] And the sound reproduction of the two output signals of an adder circuit 16 is carried out from loudspeakers 9 and 10. In addition, although the composition of an FIR filter showed the reflected-sound addition circuit 14, it is possible to generate a more natural sound effect by making the reverberation addition circuit for example, not only using this composition but the all path filter the composition added to this (following, the same).
[0071] Next, it explains, referring to drawing 6 about the sound field regenerative apparatus as the 2nd example of one gestalt of operation concerning this invention. Drawing 6 is the block diagram showing the composition of the sound field

regenerative apparatus in the 2nd example. The portion which has the same function as the 1st example attaches the same sign, and explanation is omitted. In drawing 6 , as for the signal ML (t) inputted into input terminals 1 and 2, and MR (t), a sound signal is extracted in the voice extraction circuit 13-2. The adder 13-1 adding two signals into which this voice extraction circuit 13-2 was inputted, The band-pass filter 13-3 which passes only the voice grade (for example, 100Hz - 3kHz) of a signal (BPF), The multiplier 13-5 which multiplies the output signal of a band-pass filter by the predetermined coefficient, It is constituted by the signal inputted into input terminals 1 and 2 by the multiplier 13-6 which applies a predetermined coefficient at each, 13-4, a multiplier 13-5 and a multiplier 13-6, the adder 13-8 adding the output signal of 13-7, and 13-7.

[0072] Thus, only a voice extraction circuit 13-2 which is different from the 1st example about operation of the sound field regenerative apparatus in the 2nd constituted example is explained.

[0073] The voice extraction circuit 13-2 inputs the signal inputted into input terminals 1 and 2, and adds these signals with an adder 13-1. The output signal of an adder 13-1 is inputted into a band-pass filter 13-3, and only the signal of voice grade is extracted. And the output signal of a band-pass filter 13-3 is adjusted to predetermined volume by the multiplier 13-5, and branches to two signals. Moreover, two inputted signals are adjusted to predetermined volume by a multiplier 13-4 and 13-6, respectively, and are added by an adder 13-7 and 13-8 with the output signal of a multiplier 13-5. An adder 13-7 and the output signal of 13-8 are inputted into an adder circuit 16, are predetermined volume in an adder circuit 16, and are added with the output signal of the sound field expansion circuit 15.

[0074] In addition, future operation is the same as that of the 1st example.

[0075] Next, it explains, referring to drawing 7 about the sound field regenerative apparatus as the 3rd example of one form of operation concerning this invention. Drawing 7 is the block diagram showing the composition of the sound field regenerative apparatus in the 3rd example. The portion which has the same function as the 1st example attaches the same sign, and explanation is omitted.

[0076] In drawing 7 , a delay circuit 34 is a circuit which the output signal of the voice extraction circuit 13 is inputted circuit], and delays only predetermined time. Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 3rd constituted example is explained.

[0077] The output signal of the voice extraction circuit 13 is inputted into a delay circuit 34, and only predetermined time is delayed. This adjusts the time difference with the output signal from the sound field expansion circuit 16 to produce.

[0078] In addition, future operation is the same as that of the 1st example.

[0079] Next, it explains, referring to a drawing about the sound field regenerative apparatus in the 4th example of one form of operation concerning this invention. Drawing 8 is the block diagram showing the composition of the sound field regenerative apparatus in the 4th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.

[0080] In drawing 8 , the output signal of the voice removal circuit 12 and the output signal of the voice extraction circuit 13 are inputted into the amount measurement circuit 31 of voice, and the output signal of the amount measurement circuit 31 of voice is inputted into an adder circuit 16-5. Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 4th constituted example is explained.

[0081] The amount measurement circuit 31 of voice inputs the output signal of the voice removal circuit 12 and the voice extraction circuit 13, and as shown in a formula (28), it measures the ratio (volume ratio) of the integration value in the predetermined time interval of those signals. This measurement is performed continuously.

[0082] Volume ratio = output dt of the output dt/integral voice extraction circuit of integral voice removal circuit ... (28) and this volume ratio are outputted to an adder circuit 16-5. An adder circuit 16-5 adds the output signal of the sound field expansion circuit 15 and the voice extraction circuit 13 which the value of a multiplier 16-6, 16-7, 16-8, and 16-9 is changed, and is inputted corresponding to the inputted volume ratio. For example, when a volume ratio is large, it is large in a multiplier 16-7 and the coefficient of 16-9, and a multiplier 16-6 and the coefficient of 16-8 are made small (when the output signal of the voice removal circuit 12 is larger than the output signal of the voice extraction circuit 13). It becomes possible by doing in this way to attach MERIHARI of an effect. This reverse is performed when a volume ratio becomes small.

[0083] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this volume ratio, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a volume ratio is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and enlarging a multiplier 16-6 and the coefficient of 16-8 etc. is considered.

[0084] In addition, future operation is the same as that of the 1st example.

[0085] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 5th example of one form of operation concerning this invention. Drawing 9 is the block diagram showing the composition of the sound field regenerative apparatus in the 5th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.

[0086] In drawing 9 , the signal inputted into input terminals 1 and 2 is inputted into the variation measurement circuit 32. This variation measurement circuit 32 is constituted by the adder 32-1 adding the inputted signal, and the differentiator 32-2 which differentiates the signal within predetermined time. Thus, only a different portion from the 1st example is explained about operation of the sound field regenerative apparatus in the 5th constituted example.

[0087] The variation measurement circuit 32 adds the inputted signal with an adder 32-1, and differentiates the output signal of an adder 32-1 in a differentiator 32-2 by the predetermined time interval. And this processing is performed continuously and a differential result is outputted to an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of an adder 16-6, 16-7, 16-8, and 16-9 corresponding to the differential result inputted, and adds each output value. For example, when a differential result is large, a multiplier 16-7 and the coefficient of 16-9 are made small, and a multiplier 16-6 and the coefficient of 16-8 are enlarged. By doing in this way, it is possible to decrease the unnatural feeling of the reflected sound added in the sound effect addition circuit 14.

[0088] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this differential result, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a differential result is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and the method of not adjusting a multiplier 16-6 and the coefficient of 16-8 is also considered.

[0089] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 6th example of one form of operation concerning this invention. Drawing 10 is the block diagram showing the composition of the sound field regenerative apparatus in the 6th example. In addition, the portion which has the same function as the 1st, the 4th example, etc. attaches the same sign, and omits detailed explanation.
[0090] The output signal of the amount measurement circuit 31 of voice and the variation measurement circuit 32 is inputted into an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of a multiplier 16-6, 16-7, 16-8, and 16-9 corresponding to these two inputted values.
[0091] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in an adder circuit 16-5, 16-7, 16-8, and 16-9 for the purpose of an effect.
[0092] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 7th example of one form of operation concerning this invention. Drawing 11 is the block diagram showing the composition of the sound field regenerative apparatus in the 7th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.
[0093] In drawing 11 , the output signal of the voice removal circuit 12 is outputted to the variation measurement circuit 32-3, and the output signal of the variation measurement circuit 32-3 is outputted to an adder circuit 16-5.
[0094] Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 7th constituted example is explained.
[0095] The variation measurement circuit 32-3 differentiates the inputted signal by the predetermined time interval. And this processing is performed continuously and a differential result is outputted to an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of an adder 16-6, 16-7, 16-8, and 16-9 corresponding to the differential result inputted, and adds each output value. For example, when a differential result is large, a multiplier 16-7 and the coefficient of 16-9 are made small, and a multiplier 16-6 and the coefficient of 16-8 are enlarged. By doing in this way, it is possible to decrease the unnatural feeling of the reflected sound added in the sound effect addition circuit 14.
[0096] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this differential result, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a differential result is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and the method of not adjusting a multiplier 16-6 and the coefficient of 16-8 is also considered.
[0097] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 8th example of one form of operation concerning this invention. Drawing 12 is the block diagram showing the composition of the sound field regenerative apparatus in the 8th example. In addition, detailed explanation of the portion which has the same function as the 1st, the 7th example, etc. is omitted.
[0098] The output signal of the amount measurement circuit 31 of voice and the variation measurement circuit 32-3 is inputted into an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of a multiplier 16-6, 16-7, 16-8, and 16-9 corresponding to these two inputted values.
[0099] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in an adder circuit 16-5, 16-7, 16-8, and 16-9 for the purpose of an effect.
[0100] Moreover, although voice was removed from the difference of a stereo 2ch signal, you may constitute the voice removal circuit 12 using the band limit filter which does not pass voice grade (for example, 100Hz - 3kHz), for example.
[0101] According to the above sound field regenerative apparatus, a sound signal is also clearly reproducible, and moreover, though it is an easy system configuration, a natural breadth with presence is reproducible.
[0102] In addition, each example of the gestalt of the above operation is realized using IC [DISUKURITO in practice] etc. and DSP (Digital signal processor).
[0103] Moreover, although both the sound field processing meanses of this invention explained the case where a reflected-sound addition circuit and a sound field expansion circuit were included, they may be constituted from a gestalt of the above-mentioned implementation by not only this but one of circuits. Even if there is no sound field expansion circuit, a sound signal can be reproduced clearly and, moreover, presence can be obtained.
[0104]
[Effect of the Invention] It has the advantage in which the natural breadth which this invention can also reproduce a sound signal more clearly compared with the former so that clearly from the place described above, and has presence is reproducible.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the sound field regenerative apparatus which can perform a sound reproduction with presence for example, in AV (audio-visual) device.

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PRIOR ART

[Description of the Prior Art] In order to enjoy a movie by the spread of VTRs in an image and a sound field at home in recent years, a sound reproduction with a big screen and presence is desired, and not only a movie but in order to enjoy a music title, a sound reproduction with presence is desired, and development of the hardware corresponding to this is needed.
[0003] Hereafter, it explains, referring to a drawing about the conventional sound field regenerative apparatus.
[0004] Drawing 13 is the hardware block diagram showing the composition of the conventional sound field regenerative apparatus.
[0005] The input terminal into which 1 and 2 input a signal in drawing 13 , the multiplier with which 3 hangs -1 on an input signal, The adder with which 4 adds an input signal, the delay machine to which 5 carries out the time delay of the input signal, The adder with which 7 and 8 add an input signal, the multiplier with which 6 hangs -1 on an input signal, the loudspeaker to which 9 and 10 carry out the sound reproduction of the signal outside, and 11 are the listening persons who met loudspeakers 9 and 10, and are ML (t) (t expresses continuous time and it expresses that ML (t) is a time function.). the following -- being the same -- as for the Lch signal of a stereo audio signal, and MR (t), the Rch signal of a stereo audio signal and tau 3 are the time delays in the delay machine 5
[0006] About the conventional sound field regenerative apparatus constituted as mentioned above, the operation is explained using drawing 13 .
[0007] From an input terminal 1, ML (t) is inputted, from an input terminal 2, MR (t) is inputted, the inputted signal is divided into two, respectively, MR (t) is inputted into an adder 4 and an adder 8, and ML (t) is inputted into a multiplier 3 and an adder 4. In a multiplier 3, -1 is hung on ML (t), and, as a result, it is. - ML (t) is inputted into an adder 4. In an adder 4, MR (t) and -ML(t) is added, MR(t)-ML(t) is outputted as the result, and it is inputted into the delay machine 5. Only time tau 3 delays MR(t)-ML(t) with the delay vessel 5, and MR(t-tau 3)-ML (t-tau 3) is outputted. As for the output signal of the delay machine 5, while branches to two, a signal is inputted into an adder 8, and another side is inputted into a multiplier 6. In a multiplier 6, -one is hung on MR(t-tau 3)-ML (t-tau 3), and - (MR(t-tau 3)-ML (t-tau 3)) which it is as a result is inputted into an adder 7. In an adder 8, addition of MR (t) and MR(t-tau 3)-ML (t-tau 3) is performed, and MR(t)+MR(t-tau 3)-ML (t-tau 3) which it is as a result is outputted from a loudspeaker 10. In an adder 7, ML (t) and - (MR(t-tau 3)-ML (t-tau 3)) are added, and ML(t)- (MR(t-tau 3)-ML (t-tau 3)) which it is as a result is outputted from a loudspeaker 9.
[0008] At this time, from one side of two loudspeakers to MR(t-tau 3)-ML (t-tau 3) A signal which is an antiphase mutually is mixed with an input signal, and it is reproduced. from another side, it is called - (MR(t-tau 3)-ML (t-tau 3)) -- Sound field which the normal position of an image does not understand by this are generated (or when the signal subtracted negates a cross talk component, it becomes the feeling which the right-and-left signal has become from the outside [loudspeaker / each].). . And sound field with a feeling of a breadth or presence are generated by adjusting mix balance with ML (t) which is the direct sound to which no processing processings are carried out, and MR (t).

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] It has the advantage in which the natural breadth which this invention can also reproduce a sound signal more clearly compared with the former so that clearly from the place described above, and has presence is reproducible.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, with the above composition, the mix balance of antiphase sound and a direct sound will adjust size of an effect, and when there were few effects when antiphase sound was small, and it enlarged sound / antiphase] so that an effect might be known, the technical problem that voice became not clear occurred.
[0010] The purpose of this invention is also being able to reproduce a sound signal clearly and offering the sound field regenerative apparatus which it spreads simultaneously and can make a listening person sense admiration in consideration of the above conventional technical problems.

[Translation done.]

MEANS

[Means for Solving the Problem] The voice and a non-voice signal acquisition means to acquire a sound signal and a non-voice signal from the correspondence number into which the sound field regenerative apparatus of this invention was inputted, As opposed to the non-voice signal acquired by the aforementioned voice and non-voice signal acquisition means It has a sound field processing means to perform predetermined processing for extending sound field, an addition means to add the output signal of the aforementioned sound field processing means to the sound signal obtained by the aforementioned voice and non-voice signal acquisition means, and an output means for outputting the output signal of the aforementioned addition means.

[0012] According to this this invention, the natural breadth which can also reproduce a sound signal more clearly compared with the former, and has presence is reproducible.

[0013]

[Embodiments of the Invention] The voice and a non-voice signal acquisition means to acquire a sound signal and a non-voice signal from the correspondence number into which invention of this invention according to claim 1 was inputted, As opposed to the non-voice signal acquired by the aforementioned voice and non-voice signal acquisition means It is the sound field regenerative apparatus equipped with a sound field processing means to perform predetermined processing for extending sound field, an addition means to add the output signal of the aforementioned sound field processing means to the sound signal obtained by the aforementioned voice and non-voice signal acquisition means, and the output means for outputting the output signal of the aforementioned addition means. As opposed to the non-voice signal from which the sound signal and the non-voice signal were acquired from the correspondence number into which voice and the non-voice signal acquisition means were inputted in this invention, and the sound field processing means was acquired by the aforementioned voice and non-voice signal acquisition means Predetermined processing for extending sound field is performed, the output signal of the aforementioned sound field processing means is added to the sound signal from which the addition means was acquired by the aforementioned voice and non-voice signal acquisition means, and an output means outputs the output signal of the aforementioned addition means to it.

[0014] Invention of this invention according to claim 2 is a sound field regenerative apparatus according to claim 1 which has the sound field expansion means which the aforementioned sound field processing means can make the arbitrary positions of space able to orientate an image substantially using a sound effect addition means to add a reflected sound and/or reverberation sound and to output to the aforementioned non-voice signal, and its output signal, and can extend sound field. In this invention, a sound effect addition means can add and output a reflected sound and/or reverberation sound to the aforementioned non-voice signal, and a sound field expansion means can make the arbitrary positions of space able to orientate an image substantially using the output signal, and sound field can be extended.

[0015] An input means by which invention of this invention according to claim 3 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, It is the sound field regenerative apparatus equipped with a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, the aforementioned sound field expansion means and an addition means to apply the output signal of the aforementioned voice extraction means with predetermined volume, and the two or more loudspeaker sections that emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And an addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with predetermined volume. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0016] An input means by which invention of this invention according to claim 4 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and a voice extraction means, by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and a voice extraction means using the volume ratio measured with the aforementioned amount measurement means of voice, and two or more loudspeakers which

emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by the predetermined time interval. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the volume ratio called for with the amount measurement means of voice. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0017] An input means by which invention of this invention according to claim 5 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And a variation measurement means inputs the signal inputted into the input means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0018] An input means by which invention of this invention according to claim 6 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, A voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and a variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the time variation of the volume measured with the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And a variation measurement means inputs the output signal of a voice removal means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a listening person as sound by two or more loudspeakers.

[0019] An input means by which invention of this invention according to claim 7 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the signal inputted into the aforementioned input means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by the

predetermined time interval. Moreover, a variation measurement means inputs the signal inputted into the input means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the amount of voice calculated by the amount measurement means of voice, and the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a televiewer as sound by two or more loudspeakers.

[0020] An input means by which invention of this invention according to claim 8 inputs a signal, and a voice removal means to remove a sound signal from the aforementioned signal, A sound effect addition means to add a reflected sound and/or reverberation sound to the output signal of the aforementioned voice removal means, The sound field expansion means which the output signal of the aforementioned sound effect addition means can be considered as an input, and the arbitrary positions of space can be made to be able to orientate an image substantially, and can extend sound field, An amount measurement means of voice to measure the volume ratio of the output signal of a voice extraction means to extract the aforementioned sound signal from the aforementioned signal, and the aforementioned voice removal means and the aforementioned voice extraction means, by the predetermined time interval, A variation measurement means to measure the time variation of the volume of the output signal of the aforementioned voice removal means by the predetermined time interval, It is the sound field regenerative apparatus equipped with an addition means to apply the output signal of the aforementioned sound field expansion means and the aforementioned voice extraction means using the amount measured with the aforementioned amount measurement means of voice, and the aforementioned variation measurement means, and two or more loudspeakers which emit the output signal of the aforementioned addition means as sound. In this invention, a voice removal means removes a sound signal from the signal inputted into the input means. And a sound effect addition means will add a reflected sound and reverberation sound to this signal, if the output signal of a voice removal means is inputted. Next, a sound field expansion means will carry out processing which gives a listening person right and left or the feeling which spread up and down to this signal, if the output signal of a sound effect addition means is inputted. A voice extraction means extracts a sound signal from the signal inputted into the input means. And the amount measurement means of voice inputs the output signal of a voice removal means and a voice extraction means, and asks for those volume ratios by the predetermined time interval. Moreover, a variation measurement means inputs the output signal of a voice removal means, and variation whether a time change of the signal is sharp at a predetermined time interval or loose is calculated. An addition means inputs the output signal of a sound field expansion means and a voice extraction means, and adds these signals with the amount of voice calculated by the amount measurement means of voice, and the volume corresponding to the variation calculated with the variation measurement means. And the output signal of an addition means is emitted to a televiewer as sound by two or more loudspeakers.

[0021] It is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 which the aforementioned addition means delays [time / predetermined] the output signal of the aforementioned voice extraction means, and add invention of this invention according to claim 9.

[0022] The signal with which invention of this invention according to claim 10 is added as an output signal of the aforementioned voice extraction means in the aforementioned addition means is a sound field regenerative apparatus given in any 1 of a claim 3 to the claims 8 which are a monophonic recording.

[0023] Hereafter, the form of operation of this invention is explained using drawing.

[0024] Drawing 1 is the block diagram showing the composition of the sound field regenerative apparatus which is one form of operation concerning this invention. The composition of one form of this operation is explained as the 1st example, referring to this drawing.

[0025] In addition, the portion which has the same function as the conventional example attaches the same sign, and omits detailed explanation.

[0026] In drawing 1 , the signal ML of Lch (t) inputted into the input terminal 1 and the signal MR of Rch (t) inputted into the input terminal 2 branch to two, respectively, one signal is given to the voice removal circuit 12, and the signal of another side is inputted into the voice extraction circuit 13. The voice and the non-voice signal acquisition means of this invention include the voice removal circuit 12 and the voice extraction circuit 13.

[0027] The voice removal circuit 12 consists of subtractors 12-1 which search for the difference of two inputted signals, and the output is given to the reflected-sound addition circuit 14 which adds a reflected sound to an input signal. The output signal of the reflected-sound addition circuit 14 is inputted into the sound field expansion circuit 15. The sound field expansion circuit 15 consists of the FIR filter 15-1, 15-2, 15-3, 15-4, an adder 15-5 adding an input signal, and 15-6. Here, the sound field processing means of this invention is a means including the reflected-sound addition circuit 14 and the sound field expansion circuit 15.

[0028] The voice extraction circuit 13 consists of adders 13-1 adding two inputted signals, and the output signal of this branches to two and is inputted into an adder circuit 16. Moreover, two output signals of a sound field expansion circuit are also inputted into an adder circuit 16. The adder circuit 16 consists of a multiplier 16-1, 16-2, 16-3, 16-4, and an adder 33-1 and 33-2, in order to add the signal inputted at a predetermined rate.

[0029] Two output signals of an adder circuit 16 are emitted to the listening person 11 by loudspeakers 9 and 10, respectively.

[0030] The FIR filter 15-3 and 15-4 are the FIR filters which have an impulse response which an image orientates by FIR filtering to the listening person's 11 method of right-hand side or method of the right rear, and the FIR filter 15-1 and 15-2 are FIR filters which have an impulse response which is collapsed and an image orientates according to an operation to the listening person's 11 method of left-hand side or method of the left rear.

[0031] That is, the FIR filter 15-4 has an impulse response hRR (t), the FIR filter 15-3 has an impulse response hRL (t), the FIR filter 15-2 has an impulse response hLR (t), and the FIR filter 15-1 has the impulse response hLL (t).

[0032] In addition, although not shown drawing, the power amplifier which amplifies the power of a signal minds the signal outputted to loudspeakers 9 and 10, and it is outputted to loudspeakers 9 and 10.

[0033] Thus, operation of the sound field regenerative apparatus in the 1st constituted example is explained.

[0034] First, acoustic signals, such as voice and music, are inputted from input terminals 1 and 2, it branches to two,

respectively, one signal is inputted into the voice removal circuit 12, and the signal of another side is inputted into the voice extraction circuit 13. In the voice removal circuit 12, the difference of the inputted signal is searched for by the subtractor 12-1, and it is inputted into the reflected-sound addition circuit 14.

[0035] The sound signal of the singer who orientates in the center at the time of the music signal accompanied by [signal / difference / which is searched for in the voice removal circuit 12] a singer in an input signal is offset, and serves as a reverberation component of Lch and Rch inserted at the time of recording or broadcast. For this reason, a sound signal is removable from a stereo 2ch signal. Moreover, conversely, in order to ask for the sum of the inputted signal with an adder 13-1, voice is emphasized in the voice extraction circuit 13.

[0036] Drawing 2 (a) and (b) show typically the reflected-sound sequence added in the reflected-sound addition circuit 14, and the vertical axis shows [the horizontal axis] an amplitude by time. For example, it is the reflected-sound sequence added since the reflected-sound sequence and drawing 2 (b) which are added since drawing 2 (a) outputs to the Rch side output to the Lch side. These reflected sounds are called for by the measurement in an actual hole, and the simulation using the sound ray method etc.

[0037] Drawing 3 (a) and (b) are drawings explaining the reflected-sound addition circuit 14 which actually adds this reflected sound. The delay machine with which only the time when 17 was shown by the input terminal and 18 was shown by taui (i is the same as that of a suffix and the following) is delayed in drawing 3 (a), the multiplier (it is called a tap) which performs the multiplication of the value which 19 calls tap coefficient shown by X (i), and the signal outputted from each delay machine, the adder which takes total of the signal with which 20 be outputted from each tap, and 21 When this display is performing the notation in the case of using a digital signal and it treats an analog signal, before being inputted into this reflected-sound addition circuit 14, conversion to the digital signal by the A/D converter is required (setting in one form of this operation it is the same as that of the following digital from an analog which this A/D converter omits and is shown also in the portion to be changed). Thus, the reflected-sound addition circuit 14 consists of FIR filters, it is constituted by the delay machine 18 and the tap 19, and, in the case of drawing 3 (a), a reflected-sound sequence as shown in drawing 3 (b) is acquired. On the contrary, what is necessary is just to set each amplitude X (i) and time delay taui as the tap and delay machine of drawing 3 (a) to set up a reflected sound as shown in drawing 2 (a) and (b). This is constituted by DRAM (die NAMMIKKU random access memory), DSP (digital signal processor), etc. in fact.

[0038] Like this example, when the input to the reflected-sound addition circuit 14 stereo-izes an output signal by one piece (to two signals), two circuits (FIR filter) shown by drawing 3 (a) are used, and the tap coefficient set as this sets up the thing of a different value.

[0039] Two signals with which the reflected sound was added in the reflected-sound addition circuit 14 are inputted into the sound field expansion circuit 15.

[0040] In the sound field expansion circuit 15, the signal outputted to the R side is inputted into the FIR filter 15-3 and 15-4, and the signal outputted to the L side is inputted into the FIR filter 15-1 and 15-2. In the FIR filter 15-1 and 15-2, the inputted signal collapses so that an image may orientate to the method of left-hand side [loudspeaker / 9], or a listening person's method of the left rear, and an operation is performed.

[0041] Here, how to make an image orientate in the arbitrary directions virtually is explained using drawing 4 . Drawing 4 is a principle view which generates virtually the image normal position equivalent to the case where a signal is reproduced, from the loudspeaker 25 prepared in the listening person's 11 method of left-hand side using the loudspeaker 9 of a left channel, and the loudspeaker 10 of a right channel. In this view, loudspeakers 9 and 10 are arranged ahead [of the listening person 11 / right-and-left]. And input signal S(t)22 are inputted into the FIR filters 23 and 24. The FIR filters 23 and 24 collapse an input signal by the impulse response hLR (t) set up as a tap coefficient, respectively, and hLL (t), and perform an operation. h1 (t) shown drawing is an impulse response in the position (it is the position of the eardrum correctly, and when measuring, it considers as the position of an auditory-meatus entrance) of the left ear of a loudspeaker 9 and the listening person 11. An impulse response [in / the position of the right ear of a loudspeaker 9 and the listening person 11 / similarly / in h2 (t)], An impulse response [in / the position of the left ear of a loudspeaker 10 and the listening person 11 / in h3 (t)], An impulse response [in / the position of the right ear of a loudspeaker 10 and the listening person 11 / in h4 (t)], an impulse response / in / the position of the left ear of a loudspeaker 25 and the listening person 11 / in h5 (t)], and h6 (t) are the impulse responses in the position of the right ear of a loudspeaker 25 and the listening person 11.

[0042] In such composition, when signal S (t) is outputted from a loudspeaker 25, the sound which reaches the listening person's 11 ear is as follows.

[0043] That is, sound pressure L (t) in a left ear is expressed with (1) formula.

[0044] L (t) = S(t) *h5 (t) ... (1)

Sound pressure R (t) in a right ear is expressed with (2) formulas.

[0045] R (t) = S(t) *h6 (t) ... (2)

However, * collapses and expresses the operation.

[0046] Moreover, in practice, although the own transfer function of a loudspeaker etc. will be multiplied, this may decide to ignore and may think that transfer functions, such as a loudspeaker, are included.

[0047] Moreover, time considers sound pressure [of (1) and (2) formulas], impulse response, and signal S (t) as a dispersed digital signal, and it is changed like (3), (4), (5), (6), and (7) formulas, respectively.

[0048]

L (t) -> L (n) ... (3)

R (t) -> R (n) ... (4)

h5 (t) -> h5 (n) ... (5)

h6 (t) -> h6 (n) ... (6)

S (t) -> S (n) ... (7)

In this case, (1) and (2) formulas become as shown in the following (several 1) and (several 2).

[0049]

[Equation 1]

$$L(n) = S(n) * h5(n) = \sum_{k=0}^{N-1} S(k) \cdot h5(n-k) \quad \cdots (8)$$

[0050]
[Equation 2]

$$R(n) = S(n) * h6(n) = \sum_{k=0}^{N-1} S(k) \cdot h6(n-k) \quad \cdots (9)$$

[0051] Here, the natural number n should be written by nT in practice, although T expresses the sampling time, generally omits T and writes it like (8) and (9) formulas.
[0052] Moreover, similarly, signal S (t) is emitted from loudspeakers 9 and 10, and (following 10) and following (11) formulas are materialized about the sound which reaches the listening person 11. That is, the sound pressure of a left ear serves as the following (10) formulas.
[0053]
L'(n) =S(n) *hLL(n) *h1 (n) +S(n) *hLR(n) *h3 (n) ... (10)
The sound pressure of a right ear serves as the following (11) formulas.
[0054]
R'(n) =S(n) *hLL(n) *h2 (n) +S(n) *hLR(n) *h4 (n) ... (11)
a premise [say / that sound can be heard from said if a head transfer function is equal] -- carrying out (this premise being right generally) -- the following (12) - (15) formula is materialized
[0055]
L (n) =L' (n) ... (12)
h5 (n) =hLL(n) *h1(n) +hLR(n) *h3 (n) ... (13)
R (n) =R' (n) ... (14)
h6 (n) =hLL(n) *h2(n) +hLR(n) *h4 (n) ... (15) Therefore, what is necessary is just to determine an impulse response hLL (n) and hLR (n) so that (13) and (15) formulas may be materialized.
[0056] for example, an impulse response h1 (t) - h6 (t) and hLL(t) - if hLR (t) is rewritten by expression of a frequency domain, it will become like following (16) - (23)
[0057]
H1(n) =FFT (h1 (n)) ... (16)
H2(n) =FFT (h2 (n)) ... (17)
H3(n) =FFT (h3 (n)) ... (18)
H4(n) =FFT (h4 (n)) ... (19)
H5(n) =FFT (h5 (n)) ... (20)
H6(n) =FFT (h6 (n)) ... (21)
HLL(n) =FFT (hLL (n)) ... (22)
HLR(n) =FFT (hLR (n)) ... (23)
However, FFT() expresses the function by which the Fourier transform (FFT) was carried out.
[0058] Next, if (13) and (15) formulas are rewritten by expression of a frequency domain, it collapses like (24) shown below and (25) formulas, and an operation will change to multiplication and the rest will become the transfer function which carried out the Fourier transform of each impulse response.
[0059]
H5 (n) = HLL(n) and H1(n) +HLR(n) and H3 (n) ... (24)
H6 (n) = HLL(n) and H2(n) +HLR(n) and H4 (n) ... (25)
In (24) and (25) formulas, except a transfer function HLL (n) and the value of HLR (n), since it is obtained by measurement, a transfer function HLL (n) and HLR (n) can be calculated like (26) and (27) formulas which are shown below.
[0060]
[Equation 3]

$$HLL(n) = \frac{H5(n) \cdot H4(n) - H6(n) \cdot H3(n)}{H1(n) \cdot H4(n) - H2(n) \cdot H3(n)} \quad \cdots (26)$$

[0061]
[Equation 4]

$$HLR(n) = \frac{H6(n) \cdot H1(n) - H5(n) \cdot H2(n)}{H1(n) \cdot H4(n) - H2(n) \cdot H3(n)} \quad \cdots (27)$$

[0062] Thus, determined HLL (n), hLL which carried out the inverse Fourier transform (IFFT) of the HLR (n) (n), the signal which gives signal S (n) to the FIR filters 23 and 24, and is outputted from a loudspeaker 9 using hLR (n) -- hLL (n) hLR (n) is collapsed in the signal outputted from a loudspeaker 10, and even if the listening person 11 does not actually sound the loudspeaker 25 of the method of left-hand side by emitting the signal, it can be sensed that sound is sounding from the direction. In drawing 4 , although the direction of a loudspeaker 25 was made into the method of left-hand side, the position of this loudspeaker is realizable by the same view not only depending on this but the method of right-hand side.
[0063] Therefore, it becomes possible by using the above methods to extend the sound field which an image can be made to orientate in the arbitrary directions (for the same to be said of upper and lower sides) virtually, and are reproduced rather than the time of the usual loudspeaker reproduction.
[0064] The fundamental composition of the FIR filter which calculates by collapsing is shown in drawing 5 . In this view, the

input terminal into which 26 inputs a signal, the delay element from which only tau delays a signal as for 27, the value which 28 calls tap coefficient shown by h (n) and the multiplier which performs the multiplication of an input signal, the adder with which 29 adds an input signal, and 30 are output terminals which output a signal. Usually, DSP (Digital Signal processor) and exclusive use LSI to which such an FIR filter performs ****** at high speed are used.
[0065] Impulse response h (n) and the (length of the impulse response which n:0 to N-1 and N need) are set to a multiplier 28 as a tap coefficient like drawing 5 . Moreover, the time delay corresponding to the sampling frequency at the time of changing an analog signal into a digital signal is set to a delay element 27. as [showed / (8) and (9) formulas / by repeating ****** and delay to the signal inputted into an input terminal 26, respectively / and] -- it collapses and an operation is performed this is omitted drawing, although the D/A converter which changes a digital signal into an analog signal is required for the A/D converter which changes an analog signal into a digital signal in front of this FIR filter, and back in practice, since signal processing is performed by the case of a digital signal (the following -- the same)
[0066] A loudspeaker is virtually created for an image by the FIR filter 15-1 and 15-2 as mentioned above to the method of left-hand side, or the method of the left rear, and sound field are expanded.
[0067] Similarly, in the FIR filter 15-3 and 15-4, the inputted signal collapses so that an image may orientate to the method of right-hand side, or the method of the right rear, and an operation is performed.
[0068] The output signal of an adder 15-5, the FIR filter 15-2, and the FIR filter 15-4 is inputted into an adder 15-6, and the output signal of the FIR filter 15-1 and the FIR filter 15-3 is added.
[0069] The output signal of the voice extraction circuit 13 and the sound field expansion circuit 15 is inputted into an adder circuit 16, and is added at a predetermined rate. An adder circuit 16 adds the signal inputted, respectively through a multiplier 16-1, 16-2, 16-3, 16-4 and an adder 33-1, and 33-2.
[0070] And the sound reproduction of the two output signals of an adder circuit 16 is carried out from loudspeakers 9 and 10. In addition, although the composition of an FIR filter showed the reflected-sound addition circuit 14, it is possible to generate a more natural sound effect by making the reverberation addition circuit for example, not only using this composition but the all path filter the composition added to this (following, the same).
[0071] Next, it explains, referring to drawing 6 about the sound field regenerative apparatus as the 2nd example of one form of operation concerning this invention. Drawing 6 is the block diagram showing the composition of the sound field regenerative apparatus in the 2nd example. The portion which has the same function as the 1st example attaches the same sign, and explanation is omitted. In drawing 6 , as for the signal ML (t) inputted into input terminals 1 and 2, and MR (t), a sound signal is extracted in the voice extraction circuit 13-2. The adder 13-1 adding two signals into which this voice extraction circuit 13-2 was inputted, The band-pass filter 13-3 which passes only the voice grade (for example, 100Hz - 3kHz) of a signal (BPF), The multiplier 13-5 which multiplies the output signal of a band-pass filter by the predetermined coefficient, It is constituted by the signal inputted into input terminals 1 and 2 by the multiplier 13-6 which applies a predetermined coefficient at each, 13-4, a multiplier 13-5 and a multiplier 13-6, the adder 13-8 adding the output signal of 13-7, and 13-7.
[0072] Thus, only a voice extraction circuit 13-2 which is different from the 1st example about operation of the sound field regenerative apparatus in the 2nd constituted example is explained.
[0073] The voice extraction circuit 13-2 inputs the signal inputted into input terminals 1 and 2, and adds these signals with an adder 13-1. The output signal of an adder 13-1 is inputted into a band-pass filter 13-3, and only the signal of voice grade is extracted. And the output signal of a band-pass filter 13-3 is adjusted to predetermined volume by the multiplier 13-5, and branches to two signals. Moreover, two inputted signals are adjusted to predetermined volume by a multiplier 13-4 and 13-6, respectively, and are added by an adder 13-7 and 13-8 with the output signal of a multiplier 13-5. An adder 13-7 and the output signal of 13-8 are inputted into an adder circuit 16, are predetermined volume in an adder circuit 16, and are added with the output signal of the sound field expansion circuit 15.
[0074] In addition, future operation is the same as that of the 1st example.
[0075] Next, it explains, referring to drawing 7 about the sound field regenerative apparatus as the 3rd example of one form of operation concerning this invention. Drawing 7 is the block diagram showing the composition of the sound field regenerative apparatus in the 3rd example. The portion which has the same function as the 1st example attaches the same sign, and explanation is omitted.
[0076] In drawing 7 , a delay circuit 34 is a circuit which the output signal of the voice extraction circuit 13 is inputted circuit], and delays only predetermined time. Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 3rd constituted example is explained.
[0077] The output signal of the voice extraction circuit 13 is inputted into a delay circuit 34, and only predetermined time is delayed. This adjusts the time difference with the output signal from the sound field expansion circuit 16 to produce.
[0078] In addition, future operation is the same as that of the 1st example.
[0079] Next, it explains, referring to a drawing about the sound field regenerative apparatus in the 4th example of one form of operation concerning this invention. Drawing 8 is the block diagram showing the composition of the sound field regenerative apparatus in the 4th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.
[0080] In drawing 8 , the output signal of the voice removal circuit 12 and the output signal of the voice extraction circuit 13 are inputted into the amount measurement circuit 31 of voice, and the output signal of the amount measurement circuit 31 of voice is inputted into an adder circuit 16-5. Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 4th constituted example is explained.
[0081] The amount measurement circuit 31 of voice inputs the output signal of the voice removal circuit 12 and the voice extraction circuit 13, and as shown in a formula (28), it measures the ratio (volume ratio) of the integration value in the predetermined time interval of those signals. This measurement is performed continuously.
[0082] Volume ratio = output dt of the output dt/integral voice extraction circuit of integral voice removal circuit ... (28) and this volume ratio are outputted to an adder circuit 16-5. An adder circuit 16-5 adds the output signal of the sound field expansion circuit 15 and the voice extraction circuit 13 which the value of a multiplier 16-6, 16-7, 16-8, and 16-9 is changed, and is inputted corresponding to the inputted volume ratio. For example, when a volume ratio is large, it is large in a

multiplier 16-7 and the coefficient of 16-9, and a multiplier 16-6 and the coefficient of 16-8 are made small (when the output signal of the voice removal circuit 12 is larger than the output signal of the voice extraction circuit 13). It becomes possible by doing in this way to attach MERIHARI of an effect. This reverse is performed when a volume ratio becomes small.
[0083] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this volume ratio, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a volume ratio is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and enlarging a multiplier 16-6 and the coefficient of 16-8 etc. is considered.
[0084] In addition, future operation is the same as that of the 1st example.
[0085] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 5th example of one form of operation concerning this invention. Drawing 9 is the block diagram showing the composition of the sound field regenerative apparatus in the 5th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.
[0086] In drawing 9 , the signal inputted into input terminals 1 and 2 is inputted into the variation measurement circuit 32. This variation measurement circuit 32 is constituted by the adder 32-1 adding the inputted signal, and the differentiator 32-2 which differentiates the signal within predetermined time. Thus, only a different portion from the 1st example is explained about operation of the sound field regenerative apparatus in the 5th constituted example.
[0087] The variation measurement circuit 32 adds the inputted signal with an adder 32-1, and differentiates the output signal of an adder 32-1 in a differentiator 32-2 by the predetermined time interval. And this processing is performed continuously and a differential result is outputted to an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of an adder 16-6, 16-7, 16-8, and 16-9 corresponding to the differential result inputted, and adds each output value. For example, when a differential result is large, a multiplier 16-7 and the coefficient of 16-9 are made small, and a multiplier 16-6 and the coefficient of 16-8 are enlarged. By doing in this way, it is possible to decrease the unnatural feeling of the reflected sound added in the sound effect addition circuit 14.
[0088] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this differential result, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a differential result is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and the method of not adjusting a multiplier 16-6 and the coefficient of 16-8 is also considered.
[0089] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 6th example of one form of operation concerning this invention. Drawing 10 is the block diagram showing the composition of the sound field regenerative apparatus in the 6th example. In addition, the portion which has the same function as the 1st, the 4th example, etc. attaches the same sign, and omits detailed explanation.
[0090] The output signal of the amount measurement circuit 31 of voice and the variation measurement circuit 32 is inputted into an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of a multiplier 16-6, 16-7, 16-8, and 16-9 corresponding to these two inputted values.
[0091] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in an adder circuit 16-5, 16-7, 16-8, and 16-9 for the purpose of an effect.
[0092] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 7th example of one form of operation concerning this invention. Drawing 11 is the block diagram showing the composition of the sound field regenerative apparatus in the 7th example. In addition, the portion which has the same function as the 1st example attaches the same sign, and omits detailed explanation.
[0093] In drawing 11 , the output signal of the voice removal circuit 12 is outputted to the variation measurement circuit 32-3, and the output signal of the variation measurement circuit 32-3 is outputted to an adder circuit 16-5.
[0094] Thus, only a portion which is different from the 1st example about operation of the sound field regenerative apparatus in the 7th constituted example is explained.
[0095] The variation measurement circuit 32-3 differentiates the inputted signal by the predetermined time interval. And this processing is performed continuously and a differential result is outputted to an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of an adder 16-6, 16-7, 16-8, and 16-9 corresponding to the differential result inputted, and adds each output value. For example, when a differential result is large, a multiplier 16-7 and the coefficient of 16-9 are made small, and a multiplier 16-6 and the coefficient of 16-8 are enlarged. By doing in this way, it is possible to decrease the unnatural feeling of the reflected sound added in the sound effect addition circuit 14.
[0096] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in the adder circuit 16-5 by this differential result, 16-7, 16-8, and 16-9 for the purpose of an effect. That is, when a differential result is large, in a multiplier 16-7 and the coefficient of 16-9, it is small and the method of not adjusting a multiplier 16-6 and the coefficient of 16-8 is also considered.
[0097] Next, it explains, referring to a drawing about the sound field regenerative apparatus as the 8th example of one form of operation concerning this invention. Drawing 12 is the block diagram showing the composition of the sound field regenerative apparatus in the 8th example. In addition, detailed explanation of the portion which has the same function as the 1st, the 7th example, etc. is omitted.
[0098] The output signal of the amount measurement circuit 31 of voice and the variation measurement circuit 32-3 is inputted into an adder circuit 16-5. An adder circuit 16-5 changes the coefficient value of a multiplier 16-6, 16-7, 16-8, and 16-9 corresponding to these two inputted values.
[0099] In addition, you may change adjustment of the coefficient of the multiplier 16-6 in an adder circuit 16-5, 16-7, 16-8, and 16-9 for the purpose of an effect.
[0100] Moreover, although voice was removed from the difference of a stereo 2ch signal, you may constitute the voice removal circuit 12 using the band limit filter which does not pass voice grade (for example, 100Hz - 3kHz), for example.
[0101] According to the above sound field regenerative apparatus, a sound signal is also clearly reproducible, and moreover, though it is an easy system configuration, a natural breadth with presence is reproducible.
[0102] In addition, each example of the form of the above operation is realized using IC [DISUKURITO in practice] etc. and DSP (Digital signal processor).
[0103] Moreover, although both the sound field processing meanses of this invention explained the case where a

reflected-sound addition circuit and a sound field expansion circuit were included, they may be constituted from a form of the above-mentioned implementation by not only this but one of circuits. Even if there is no sound field expansion circuit, a sound signal can be reproduced clearly and, moreover, presence can be obtained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the hardware block diagram of the sound field regenerative apparatus in the 1st example of one gestalt of operation concerning this invention.
[Drawing 2] Drawing 2 (a) and (b) are drawings explaining the reflected-sound addition method of the sound field regenerative apparatus in the 1st example of this invention, and are drawing showing the reflected-sound sequence added since drawing 2 (b) outputs the reflected-sound sequence added since drawing 2 (a) is outputted to the Rch side to the Lch side.
[Drawing 3] Drawing 3 (a) is a block diagram explaining the composition of the reflected-sound addition circuit of the sound field regenerative apparatus in the 1st example of this invention, and drawing 3 (b) is drawing showing a reflected-sound sequence.
[Drawing 4] It is a block diagram explaining the principle of the FIR filter of the sound field regenerative apparatus in the 1st example of this invention.
[Drawing 5] It is drawing explaining the composition of the FIR filter of the sound field regenerative apparatus in the 1st example of this invention.
[Drawing 6] It is the hardware block diagram of the sound field regenerative apparatus in the 2nd example of this invention.
[Drawing 7] It is the hardware block diagram of the sound field regenerative apparatus in the 3rd example of this invention.
[Drawing 8] It is the hardware block diagram of the sound field regenerative apparatus in the 4th example of this invention.
[Drawing 9] It is the hardware block diagram of the sound field regenerative apparatus in the 5th example of this invention.
[Drawing 10] It is the hardware block diagram of the sound field regenerative apparatus in the 6th example of this invention.
[Drawing 11] It is the hardware block diagram of the sound field regenerative apparatus in the 7th example of this invention.
[Drawing 12] It is the hardware block diagram of the sound field regenerative apparatus in the example of the octavus of this invention.
[Drawing 13] It is the hardware block diagram of the conventional sound field regenerative apparatus.
[Description of Notations]
1 Two Input terminal
12 Voice Removal Circuit
12-1 Subtractor
13 Voice Extraction Means
13-1 Adder
14 Reflected-Sound Addition Circuit
15 Sound Field Expansion Circuit
15-1 to 15-4 FIR filter
15-5, 15-6 Adder
16 Adder Circuit
16-1 to 16-4 Multiplier
33-1, 33-2 Adder
9 Ten Loudspeaker
11 Listening Person

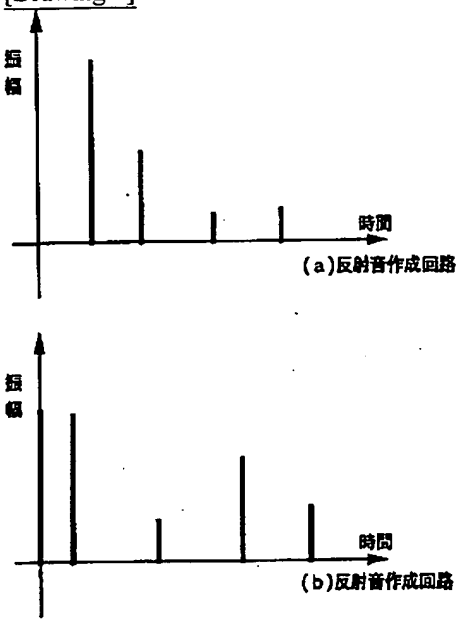
[Translation done.]

* NOTICES *

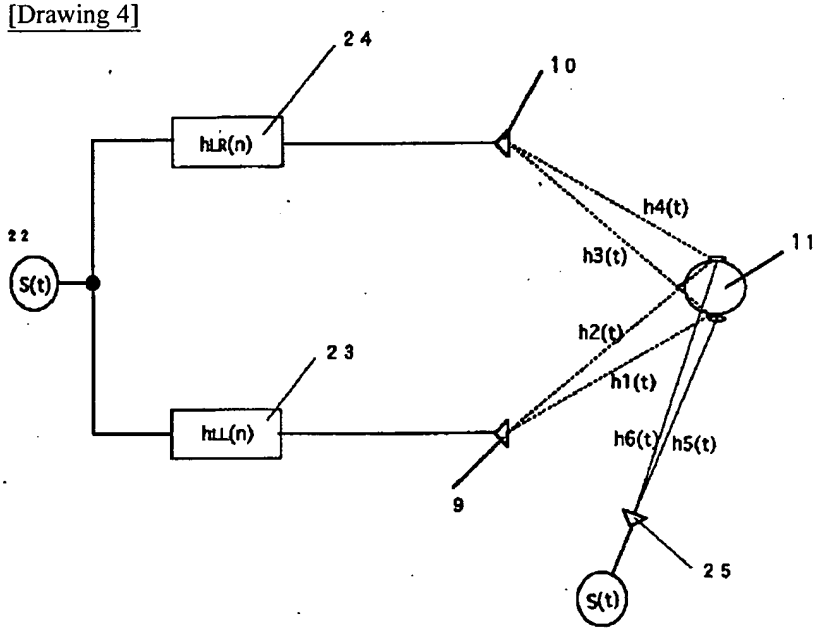
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

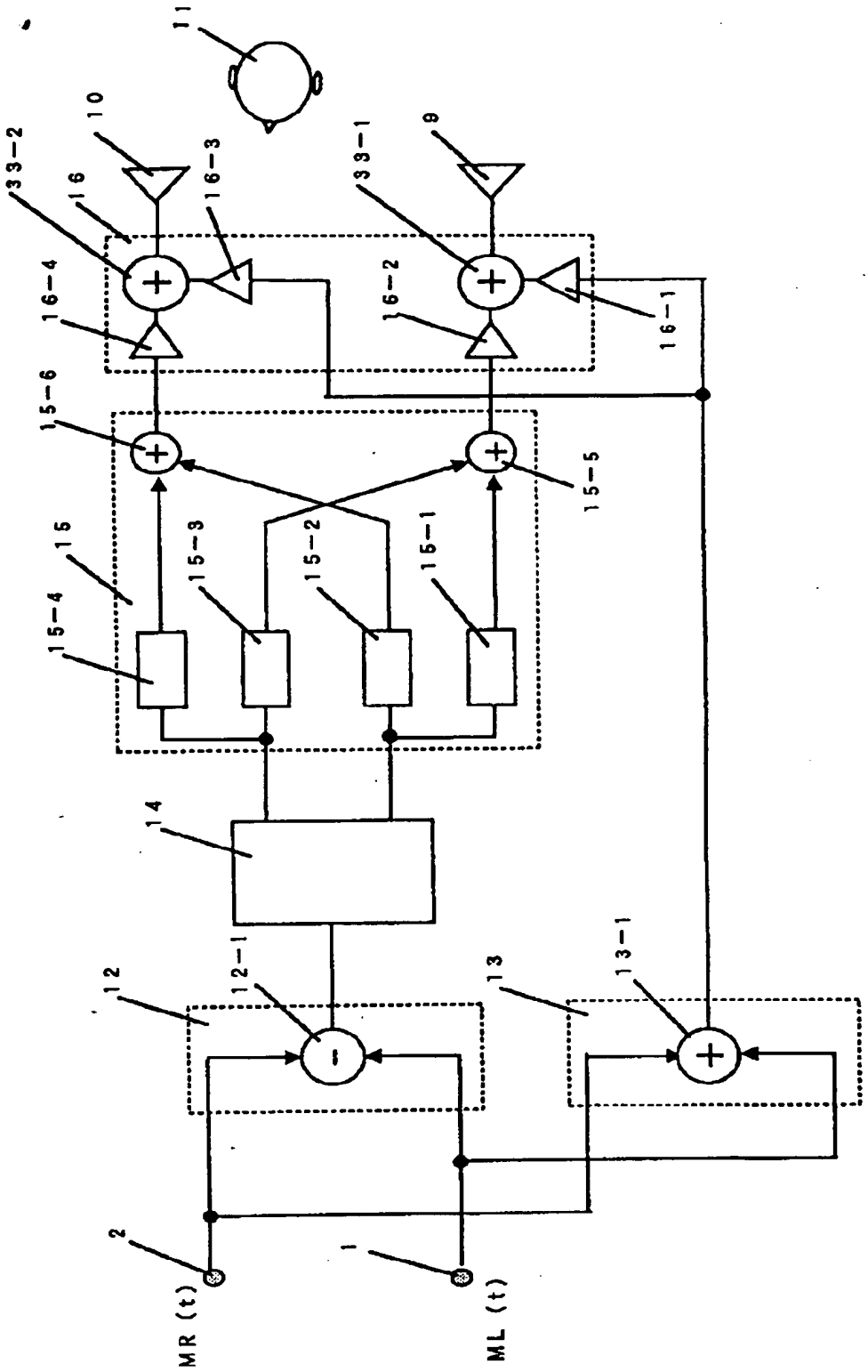
[Drawing 2]



[Drawing 4]



[Drawing 1]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16-1
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15-3
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15-4
14
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12-1
13
13-1
2
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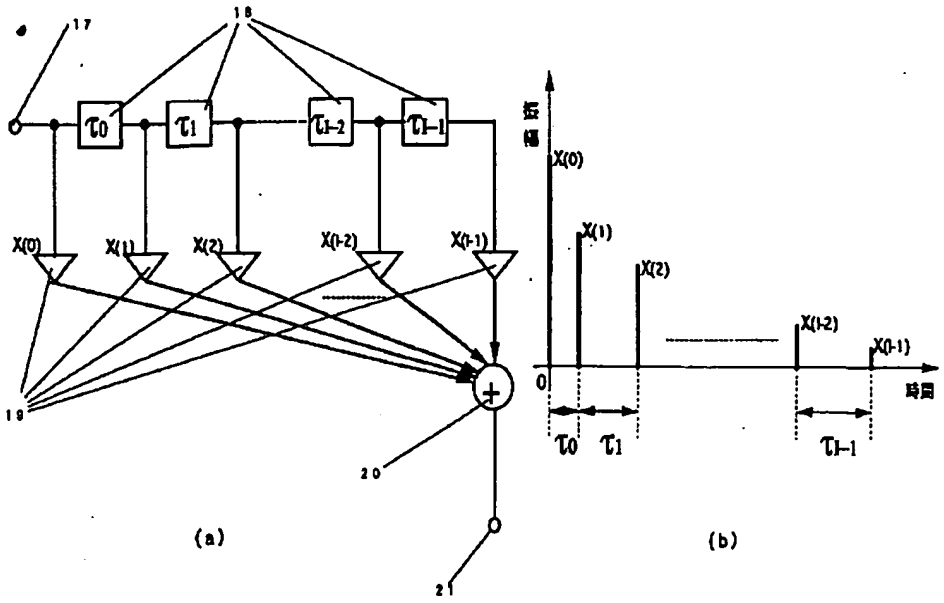
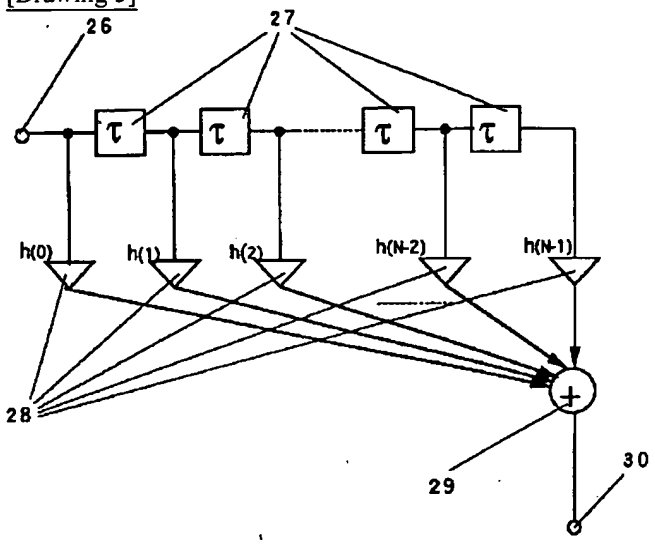
MR (t)
ML (t)

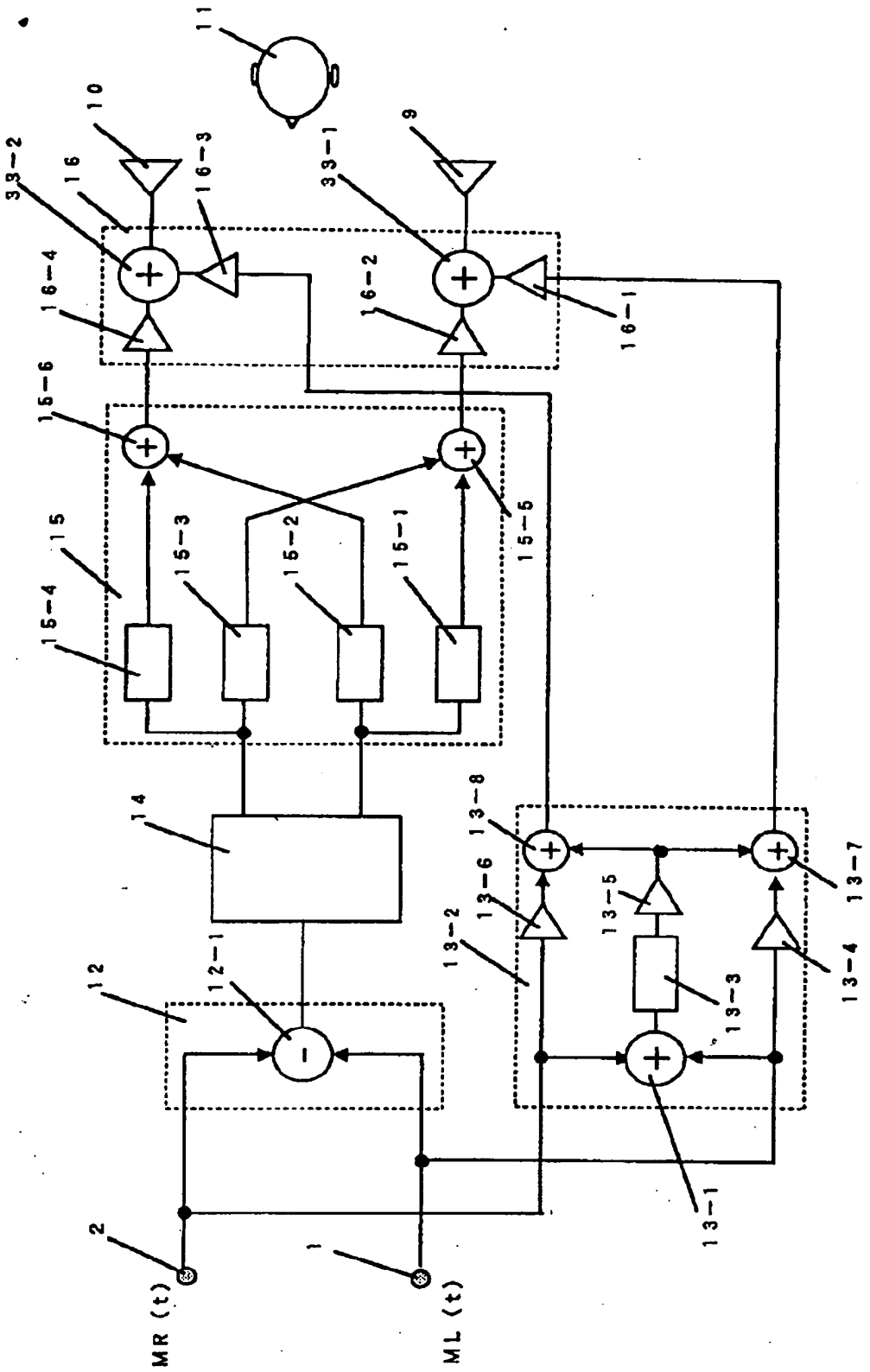
[Drawing 3]



[Drawing 5]



[Drawing 6]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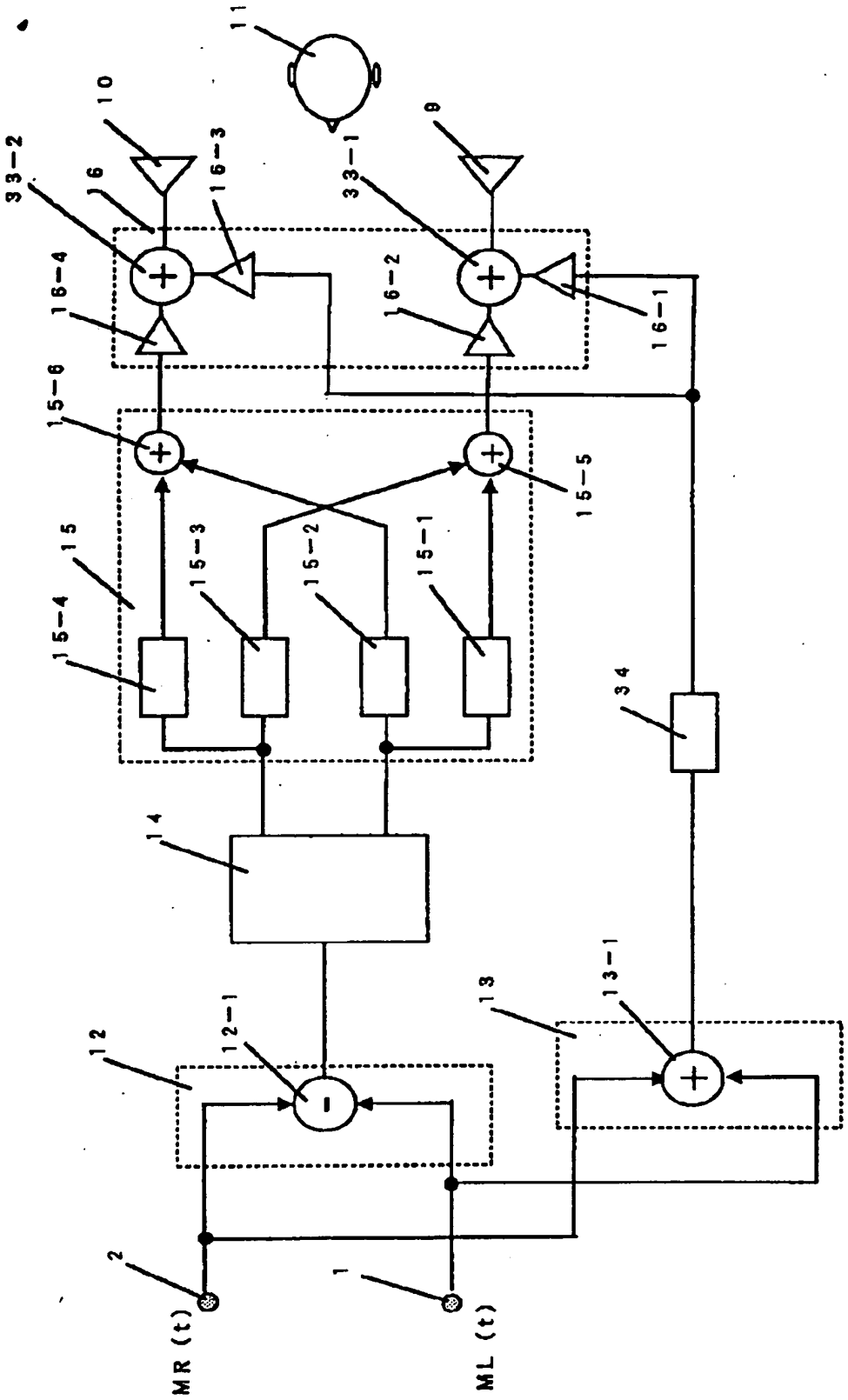
[Drawing 7]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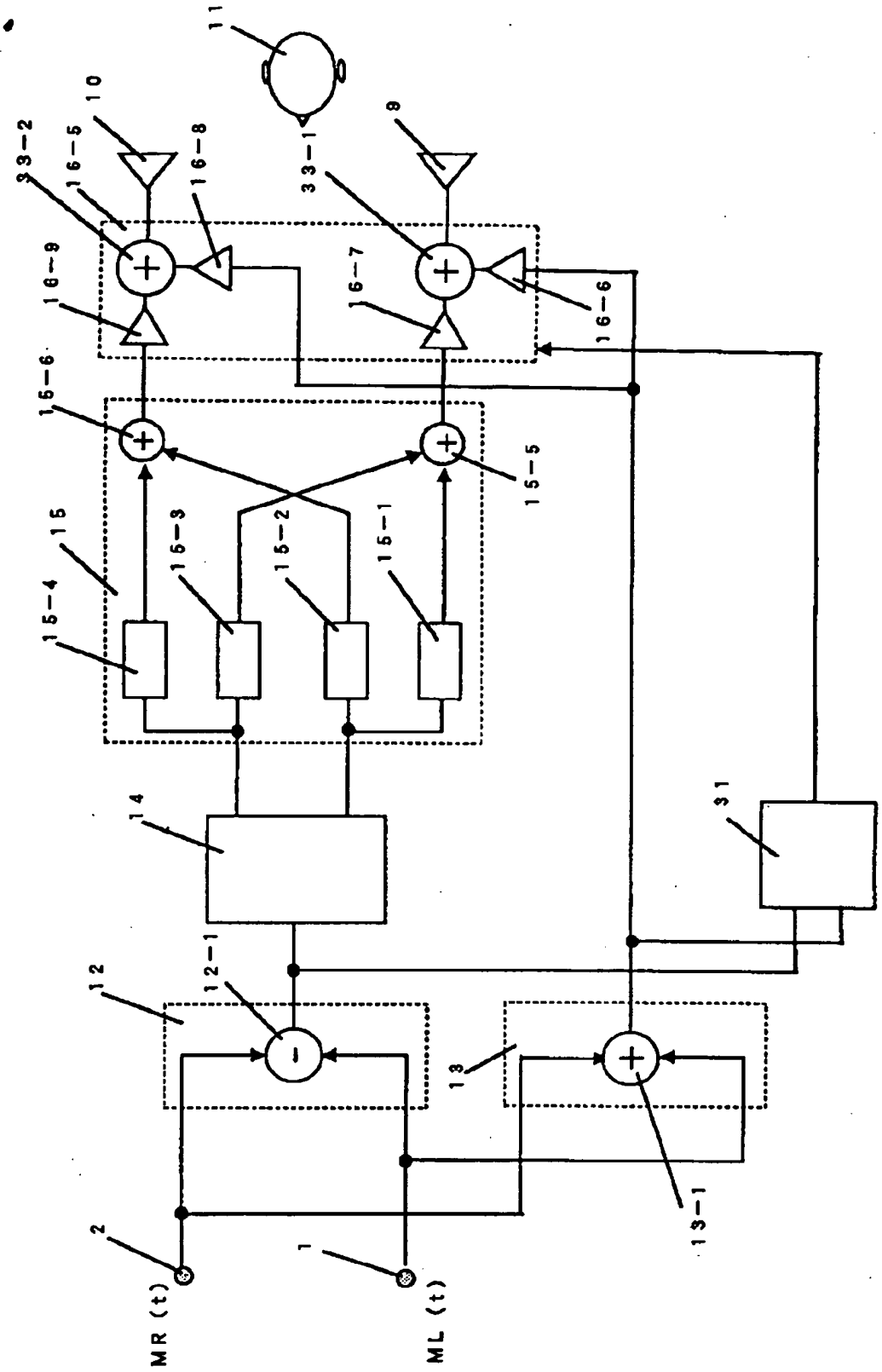
ML (t)

[Drawing 8]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MR (t)
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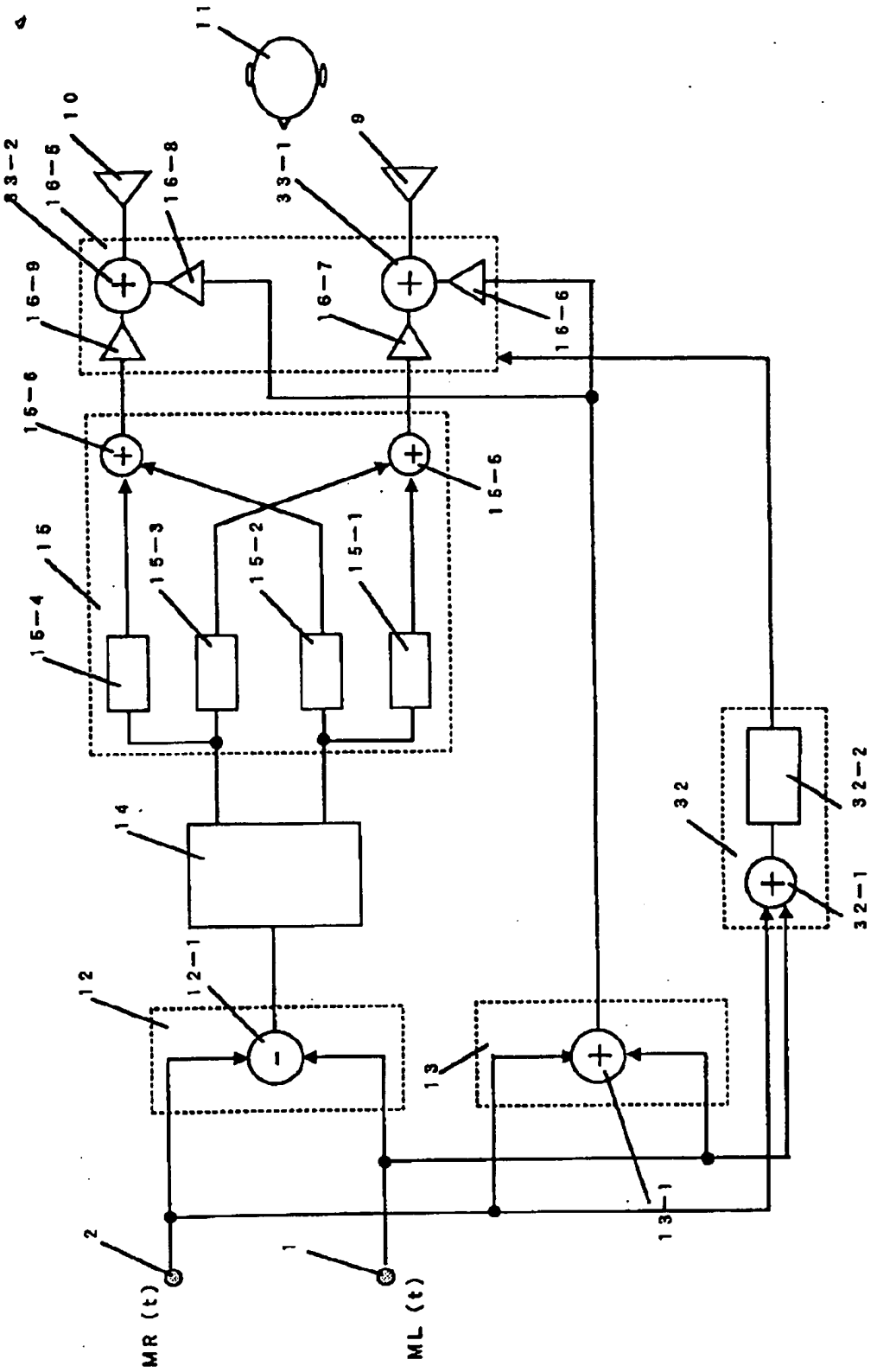
[Drawing 9]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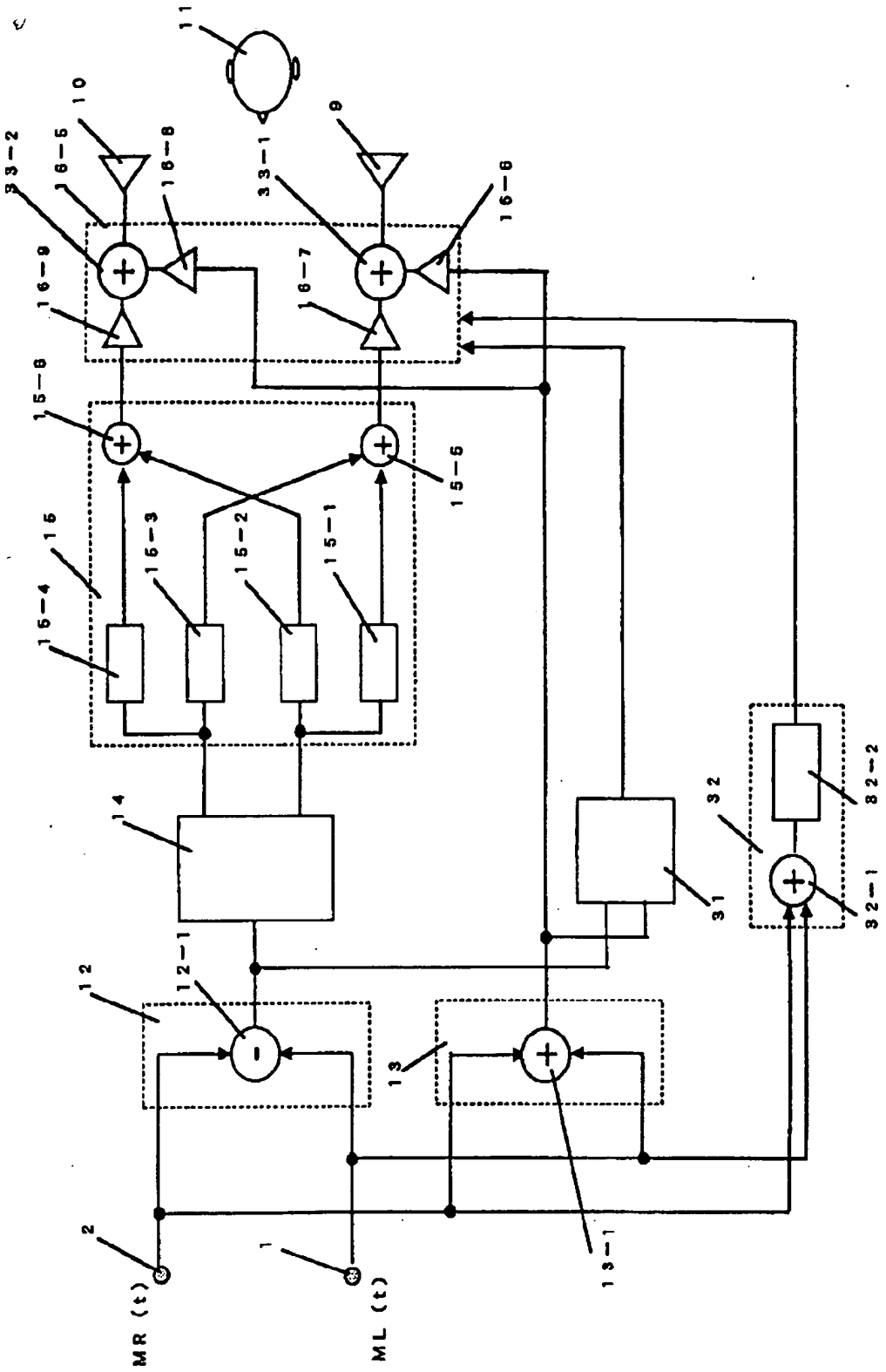
[Drawing 10]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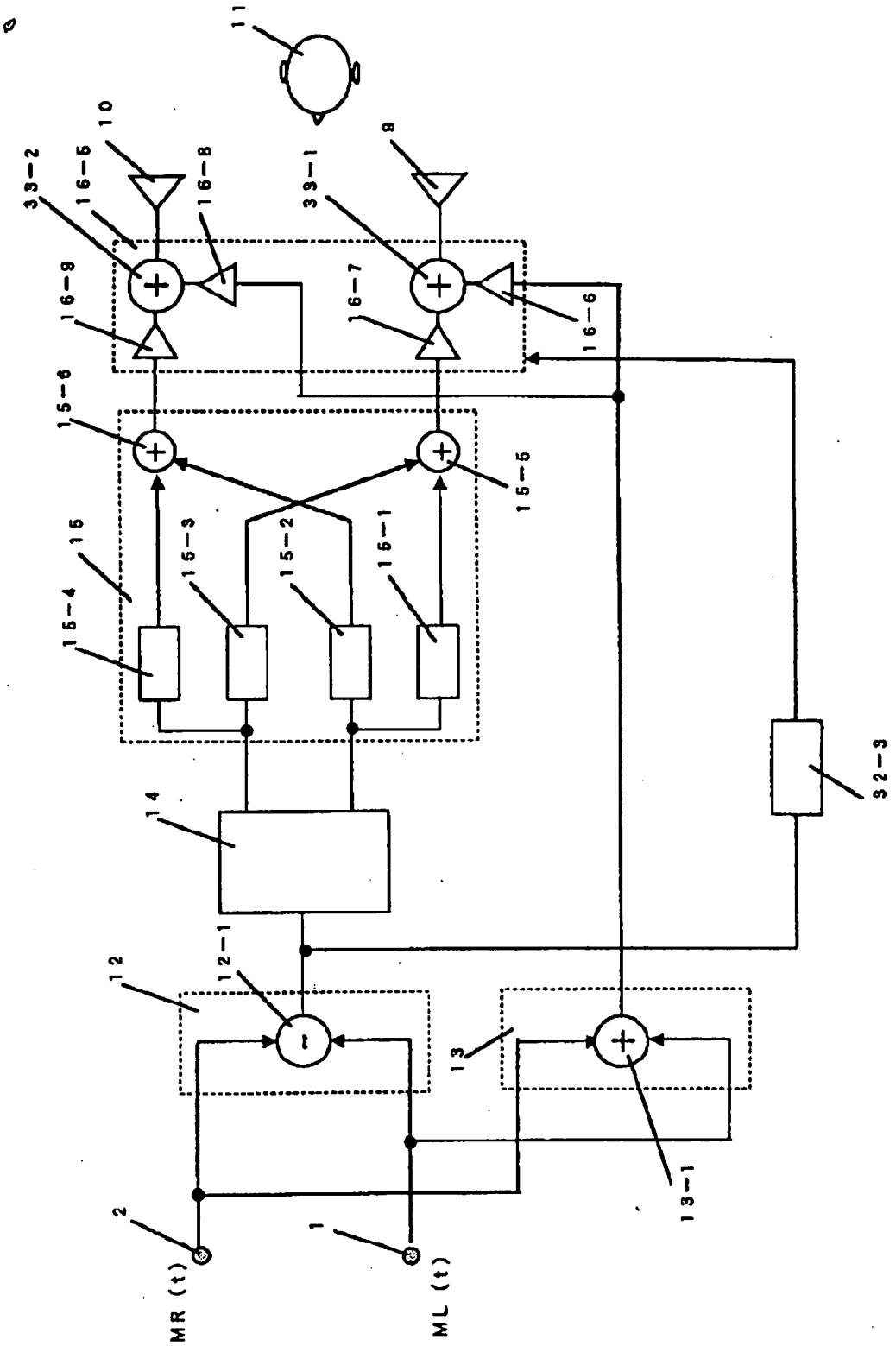
MR (t)
ML (t)

[Drawing 11]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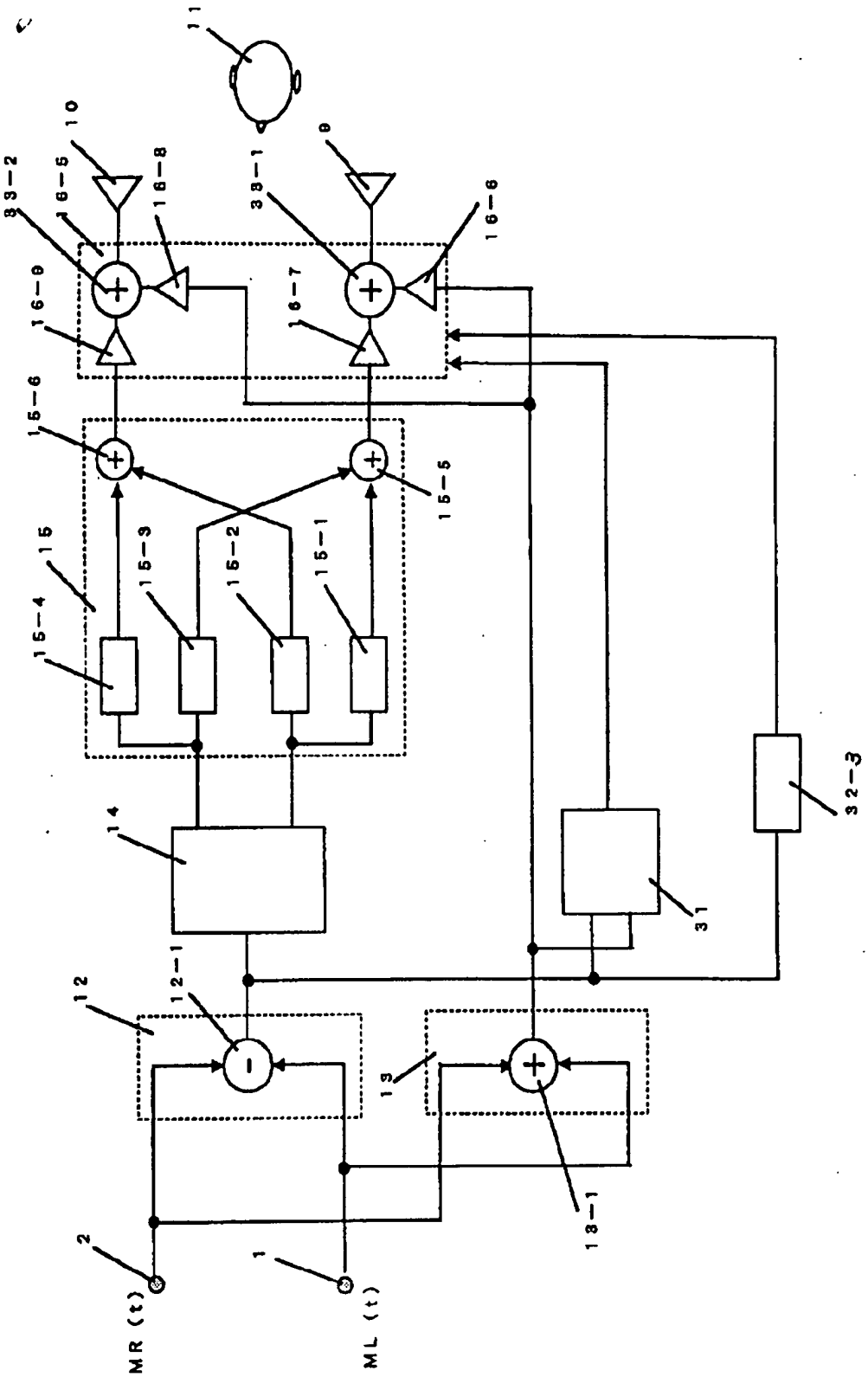
MR (t)
ML (t)

[Drawing 12]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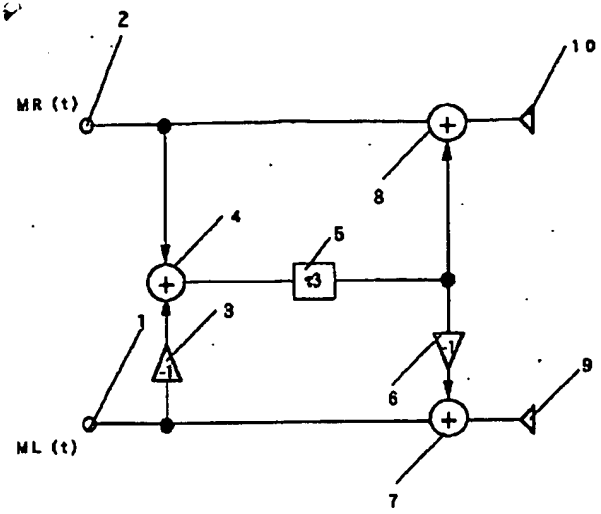
ML (t)

[Drawing 13]



[Translation done.]